THE

ELECTRICAL REVIEW.

VOL. LXXXIII. SEPTEMBER 27, 1918. No. 2,131.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY

OFFICE : 4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGREKAY, CENT., LONDON." Code, A B C
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

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THE GREATEST INDUSTRIAL PROBLEM.

THE Committee on Relations between Employers and Employed appointed by the Ministry of Reconstruction has got to the end of its tether. In other words, having been appointed for the purpose of making and considering suggestions and advancing recommendations, it has finished its work. It had to consider (1) what could be done to secure permanent improvement in industrial relations; and (2) to recommend means for the systematic review of industrial conditions affecting those relations, so that future improvement in conditions could be ensured.

What the Committee has accomplished is well known. It has recommended the setting-up of joint industrial Councils, District Councils, and Works Committees on lines which are familiar to our readers. The furtherance of those very desirable objects is in the hands of others, and that very important work is making a measure of progress. What remains, then, for the Committee to do, save to issue a final report, in which it reaffirms its conviction of the urgency of the matter? There will be found none, we believe, to question the soundness of the conviction that we have arrived at a stage of the war when of any further action respecting industrial relations it must be said, "What thou doest do quickly!" There is, says the Committee, "pressing need that every organised industry should equip itself with a representative machinery capable of dealing with the large questions of common interest to employers and employed arising in war-time, during demobilisation, and in the period after the war." The hope is expressed that when the Joint Councils have gained confidence and experience in dealing with the urgent problems of the moment, they will find their sphere of usefulness to be much wider than they imagined at their inception. We quite think that this will be so, but the urgent problems of the moment are enough to go on with, and it is useless to ignore the fact that confidence and experience will not be established or gained very rapidly. Certain Councils and Committees are at work, and the Ministry of Labour has a Department engaged in collecting and codifying the results of their activities and experience—such as they are; but notwithstanding all the propaganda and other effort down to date, we cannot pretend that the termination of the labours of the Whitley Committee finds us where we ought to be if we are going to have machinery capable of rendering the required service in the critical times that lie ahead. Really we have not got much further than to secure a fairly general discussion of the merits of the Whitley idea, and a commencement of its practical application in a few directions, and some recommendations on conciliation and arbitration, together with proposals for a Standing Arbitration Council to deal with differences or disagreements.

It would be unwise to ignore the opposition to the Whitley

idea that exists in the engineering industry and in some other sections. That opposition, as we have intimated on several occasions, centres around the question of "control" of industry. Everything depends, we suppose, upon what is meant by "control." If it means giving all classes of workers an interest in the profits of a business, that is a proposition definite enough to form the basis of discussion, given a suitable attitude on both sides. If the employing side flatly refuses it without fair consideration, closing its eyes to all the signs that have been written during the last four years, with an indisposition to reduce the spirit of self-interest or to show any accommodation, it must not be supposed under to-day's conditions that there the matter will end. What does the Committee say on this point as it closes its labours?

On the question of the adoption of schemes of Profit-sharing and Co-partnership we have considered the evidence at present available, and have felt bound to come to the conclusion that it does not justify us in putting forward any general recommendations.

Is it possible to congratulate the Committee upon this inconclusive conclusion? It has recommended measures for giving the several industries a large share of self-government through Joint Industrial Committees, but it trembles at the thought of going further, and leaves the problems that are already on the horizon with the Ministry of Labour and the Ministry of Reconstruction, and with the Industrial Councils, because if it undertook further inquiries there would be overlapping. Of course, it was hardly to be expected that a Committee representing directly opposite interests would be able to come to a completely unanimous conclusion, unless in the nature of a very definite compromise, and we seem to be able to read into the wording of this final report the existence of a good deal of difference of opinion and laborious discussion between the members themselves. Confirmation of this thought is found in a minority report signed by J. R. Clynes, J. A. Hobson, A. Susan Lawrence, J. J. Mallon, and Mona Wilson. These members say:—

While recognising that the more amicable relations thus established between Capital and Labour will afford an atmosphere generally favourable to industrial peace and progress, we desire to express our view that a complete identity of interests between Capital and Labour cannot be thus effected, and that such machinery cannot be expected to furnish a settlement for the more serious conflicts of interests involved in the working of an economic system primarily governed and directed by motives of private profit.

Thus we find that these members, while they concur in the general inability of the Committee to make recommendations respecting profit-sharing and co-partnership, are unable to foresee a continued period of industrial content so long as we have private enterprise as the great impelling force in industry, for that is what they mean by "the motives of private profit." They want little short of State control of industry, which would mean that Labour would share the profits, if any, with the State, or that the whole nation should be in co-partnership in all industry. Otherwise, in their opinion, we cannot avoid serious conflicts. Is there available any evidence to justify the belief that industrial peace would be secured by the elimination of private interest? Would it be worth having at such a price? Would international competition considerately eliminate itself? Has the war changed human nature?—of course it has not. Apparently the full Committee, when properly limiting itself to the terms of its appointment, considers that it has advanced recommendations which, when they are generally applied, will be likely to secure "a permanent improvement in the relations between employers and workmen"; but the zeal of the minority seems to have carried them much further, and to have brought them up against the entire economic system of industry, because it will not permit of what, if we may say so, is the impossible—the elimination of our very common human nature and its weaknesses. We, of course, recognise that many of the differences that arise in industry are based on little else than the suspicion that the employer or the shareholder is taking more than his share, while there is lacking any authority which can settle what the respective shares ought to be of both the profits and the losses. To suggest, however, that there is no middle course which will help us to conduct human affairs on lines which shall be equitable to Capital and Labour alike, savours more of the sentiment of the heart than of the common-sense of the mind. In one of his lectures already referred to somewhat fully in these pages, Mr. W. L. Hichens suggested the limitation of the rate of dividend on industrial capital. We believe that in the days to come some such measure will be more widely and more seriously discussed. A complication may enter when there are no profits to divide after wages have been raised and better conditions ensured. The rate of dividend would presumably be such that the risk of lean years or years of actual loss would be prepared against by the establishment of equalisation funds after due provision had been made for financial stability of the business. Labour would not be prepared to bear the losses, but would risk the loss of employment if the concern were compelled to shut down. It might be able to secure work elsewhere or to draw State unemployment insurance, but the shareholder would not be able to recover his lost capital.

The circumstance that the full Committee can make no recommendations concerning middle courses, while the minority can advance nothing more than nationalisation of everything, inclines us to see that all that remains at the end of this final Report is the hope that is inspired by the Whitley Industrial Councils. That hope is growing, as we are heartily glad to see, but, in our opinion, the mountain of deliberative effort has brought forth only a mouse if we consider it in comparison with the huge wall of difficulty that will be confronting us when the war ends. Of course, we speak comparatively; we have never hesitated to give the strongest possible approval to the Whitley principles, but these alone will not suffice to quench the fires that we fear may burst out if something does not happen to change the spirit of many workers and to curb the activities of recalcitrant minorities who delight in strife.

Far be it from us to withhold credit from those to whom it is due, or to encourage a gloomy outlook respecting the future; but in view of the vagueness of public utterances of statesmen and politicians, and of the fact that Dr. Addison's Committee has terminated its labours, of the unquestionably strong movements of an uncertain character that exist in many parts of the country, of the possibly sentimental view in regard to industrial conditions that women voters may be expected to exercise at the polls when we come to an election, we think the time has arrived for a round table conference as suggested by the Alliance of Employers and Employed. It is time to see whither we are tending, and, if possible, conceive means for averting a calamity which will bring no good but only harm to both sides.

The decision in the case of the railwaymen's latest demand is encouraging the idea that wages must rise in proportion to the increase in the cost of living, and at the moment of going to press a strike is in progress. We venture to believe that some classes of workers would be poorer than they are to-day if their advances had been thus regulated; they would not be buying pianos, paying for the best provisions, and giving the bootmaker or the draper whatever price he liked to ask. If the proportional increase principle is to be State approved the State ought to bring its weight more influentially to bear in keeping down the cost of living. In many parts of the country the shopkeeper is reaping a harvest. Who pays? The people, who, in consequence, are always "asking for more."

The next best evil to an inconclusive peace is the continuation of the present tendencies in the industrial world, and to cope with these the Whitley principle is seemingly impotent.

Canadian Guilds of Research.

Our Special Correspondent in Canada reports that the Honorary Advisory Council for Scientific and Industrial Research is advocating the establishment in Canada of Guilds for Research. The Council points out that the majority of Canadian industries are relatively small, and, consequently, have not the resources to undertake research but by means of Guilds. All firms in a particular line of industry would be linked together in order that these expenses might be pooled. It is hinted that if the levies or subscriptions of the firms to the Guild are insufficient to meet expenses, assistance may be given for a period of years by the Government.

Some of the advantages which would accrue to members of such Guilds are stated as follows :—

The results of all research work undertaken by the Guild will be immediately available to each and every member.

The right to recommend specific problems for research, and, if the problems be approved by the Committee of Management, the right to have the research carried out without cost to the firm suggesting them.

The right to a periodical service of information for the purpose of keeping in touch with all technical developments of the particular industry in question.

Firms which did not join a Guild would naturally not be in a position to compete with those which did, especially in those cases in which great economy had been effected by improved processes. All information of this nature would, of course, be denied them

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Fuel Economy.

The crucial importance of the fuel question, and the imperative necessity of rigid economy in the consumption of coal as a war measure, are being pressed upon the public attention by the Coal Controller as urgently as possible. A Conference of London Mayors and municipal officials was held for this purpose on Friday last, at which the President of the Board of Trade and the Coal Controller made statements on the subject, and an instructional pamphlet containing useful hints to consumers is about to be issued. It is clear that during the coming winter there will be a serious deficiency in our supplies of fuel, apart from the rationing scheme, and it is the duty of every patriotic householder or other consumer to restrict his consumption to the barest possible minimum.

In the article commencing on this page, Mr. E. C. de Segundo discusses the comparative values of the various forms of fuel on the bases of cost and heating "effectiveness," making due allowance for the efficiencies of conversion. His results, indicating that in spite of the deplorably low efficiency of domestic grates and ranges, coal is the cheapest form of fuel for heating, and at the same time makes the least demand upon our resources, when assessed on the above bases, are in accordance with those of previous writers on this subject. In passing, we may point out that the figure which he has taken for the coal consumption per KW.-hour—5·5 lb.—is, to our mind, a liberal one, and may be criticised by the managers of large generating stations; but the author states that he has adopted this figure as an average for large and small plants throughout the country.

There is, however, another aspect of the matter to which attention should be drawn—namely, the use factor. It is well known to electrical men that the consumption of electricity for lighting and heating, in the hands of careful people, falls far below the amount that would be anticipated on the basis of watt-hours per candle-hour or per thermal unit, simply because the current is so easily switched off when not required. Hence it does not follow from the figures that the actual consumption of electricity would be nearly so great as would appear, and in view of the enormous demand that has sprung up during the war for electric heating apparatus, which could not have happened if the cost had been prohibitive, we believe that in reality the use of electric fires is not wasteful of fuel.

As for electric cooking, that is not in doubt; the economy of this method of cooking has been established, and its increasing adoption in the National Kitchens bears testimony to its merits.

THE HOUSEHOLDER AND CLAUSE 7 OF THE COAL RATIONING ORDER.

By Ed. C. De Segundo, A.M.Inst.C.E.

There seems to be a widespread feeling of perplexity amongst householders with regard to their position under the provisions of Clause 7 of the "Household Fuel and Lighting Order, 1918." This clause reads as follows :—

> Fuel may be taken as coal, gas, or electricity at the option of the consumer in accordance with the following rules (Clause 7) :—
> In calculating a ton of fuel :—
> (*a*) Anthracite shall count as fuel at the same rate as ordinary coal.
> (*b*) 3 tons of coke shall count as 2 tons of fuel, and so in proportion for other quantities.
> (*c*) Briquettes (not exceeding 2½ lb. in weight) shall count as 1,000 to the ton.
> (*d*) 15,000 cb. ft. of gas shall count as 1 ton of fuel.
> (*e*) 800 Board of Trade units of electricity shall count as 1 ton of fuel.
> The quantity of fuel to be taken as gas or electricity must be calculated to the nearest quarter of a ton.

The non-technical public appear to assume—and, perhaps, not unnaturally, from the wording of the clause—that the words "shall count as" are synonymous with "is equivalent in heating value to," and, further, that it is immaterial, not only as regards the quantity of heat obtained, but also as regards the eking out of our coal supplies, whether a ton of anthracite, or a ton of coal, or a ton and a half of coke, or 15,000 cb. ft. of gas, or 800 Board of Trade units of electricity be consumed.

This is, of course, not the intent of the Order, and anyone possessing a rudimentary knowledge of thermal equivalents knows that the calorific values of the quantities just mentioned are by no means equal; but it is, perhaps, not realised how widely different they are, nor is it fully apparent at first sight, even to the technical man, why the authorities are so anxious that the consumption of gas and of electrical energy should be curtailed in the greatest possible measure during the coming months.

A few figures and explanations may, perhaps, serve to enable the public to see more clearly in the matter. The calorific values and prices in London to-day may, for the purposes of rough comparison, be taken as follows :—

	Calorific value. Therms.	Price (present time).
British anthracite, per lb. ...	15,000	61s. 6d. per ton.
Coal, per lb.	14,000	44s. 6d. „ „
Coke, per lb.	12,500	(say) 44s. 0d. „ „
Coal gas (present day) per cb. ft.	500	„ 4s. 0d. per 1,000 cb. ft.
KW.-hour	3,400	„ 1½d.

The prices of gas and electrical energy vary in different parts of London, but the above assumptions are sufficiently near the mark for the purposes of my argument. The heat values of the quantities mentioned in Clause 7 of the Order, and the cost per million therms at present prices, may be taken as under :—

	Therms.	Pence.
1 ton anthracite (British) ...	33,500,000	22
1 ton coal	31,000,000	17·2
1½ tons coke	42,000,000	19·0
15,000 cb. ft. of gas	7,500,000	96·0
800 KW.-hours	2,700,000	444·0

At first blush, therefore, the householder who consults his Molesworth or his Kempe, jumps to the conclusion that the authorities are either crassly ignorant, or are seeking to make him pay for sources of heat somewhat in inverse proportion to their heat values. A few days ago a statement appeared in one of the daily newspapers to the effect that Prof. *X.* had pointed out that 30,000 cb. ft. of gas was the proper "householder's equivalent" of a ton of coal. It is not easy to see upon what principle this figure is arrived at. The determination of what might be termed the "effective" equivalents with any degree of scientific accuracy is scarcely possible, for reasons which I need hardly point out to readers of a technical journal.

In view of the abnormally low stocks, and of our impaired productive capacity, the Coal Controller is faced with the necessity of devising ways and means whereby the coal consumed throughout the country may become productive of the

highest "effective" results, and—so far as the householder is concerned—whereby the amount of heat necessary to enable him to keep himself warm, cook his food, and light his house during the coming months, may be obtained at a minimum expenditure of fuel. Available labour and transport facilities are necessarily dominant factors in the situation, so that the determination of the "equivalents" in Clause 7 has been by no means merely a matter of simple arithmetic, and, at best, can only be of the nature of a compromise.

Now, the chief concern of the average man is how to keep his house suitably warmed during the cold weather, and we may, therefore, take the fuel consumption for heating as our basis for discussion. It is well known that in open fireplaces of the type found in the vast majority of houses in London, probably 90 per cent. of the heat value of the coal consumed is wasted owing to incomplete combustion, to the mania most people have for poking the fire, and to the heat escaping with the products of combustion up the chimney, but let us take 85 per cent. as the average loss, all round, in coal-fired heating apparatus. In some types of gas fire the percentage of heat lost may be higher than 90 per cent. In gas stoves connected to a flue (as, of course, they all should be), even assuming the combustion to be complete, certainly over 50 per cent. of the heat will be lost as far as radiation into the room is concerned. In certain types of electric heater it may be assumed that practically the whole of the thermal equivalent of the electrical energy dissipated is of value for warming the room. Let us assume a loss of 10 per cent.

On the basis of the above efficiencies, the "effective" heat obtained by the householder from the five commodities becomes :—

1 ton anthracite ...	(about)	5,000,000 therms.
1 ton coal		4,500,000 "
1½ tons of coke		6,000,000 "
15,000 cb. ft. of gas		3,400,000
800 KW.-hours		2,400,000

We next have to look into the fuel consumed in gas works and central electric generating stations per 15,000 cb. ft. of gas and per 800 KW.-hours supplied to the householder.

In the production of gas 1 ton of coal is converted, on the average, into about 10,000 cb. ft. of gas and about 1,500 lb. of coke, plus about 180 lb. of residual products, which do not enter into our calculations. About 25 per cent. of the coke made is consumed in heating the retorts, so that the fuel required for the production of 15,000 cb. ft. of gas is about 1¾ tons. I am informed that about 94 per cent. of the gas produced is accounted for in the meter readings, so that 15,000 cb. ft. registered by the householder's meter corresponds, on the average, to nearly 1·9 tons of fuel consumed at the gas works.

SUMMARISED RESULTS.

Estimated "effective" heat (average efficiency of open grates and other coal-fired apparatus used by householder, taken at 15 per cent.). (Therms.)	Anthracite. 1 ton. 5,000,000	Coal. 1 ton. 4,500,000	Coke. 1½ tons. 6,000,000	Gas. 15,000 cb. ft. —	Electricity. 800 units. —
Average efficiency of gas fires and gas stoves, 45 per cent. (Therms.) ..	—	—	—	3,400,000	—
Electric heater (for heating rooms, say 90 per cent. efficiency). (Therms.) ..	—	—	—	—	2,400,000
Cost. (Pence.)	708	534	792	720	1,600
Relative cost (coal taken as unity)	1·38	1·00	1·48	1·35	3·00
Demand on coal resources. (Tons.)	1	1	2·25	1·86	2·10
Cost per 1,000 therms "effective" heat. (Pence.)	0·148	0·119	0·132	0·21	0·50
Relative cost (coal taken as unity)	1·24	1·00	1·11	1·77	5·03
Demand on coal resources per 4,500,000 therms "effective" heat obtained by householder. (Tons.)	0·9	1·00	1·69	2·2*	3·8

*Of this quantity about 1·1 tons net of coke would be available for sale, but 2·2 tons of coal would have to be *provided* in the first instance.

The coal consumption per KW.-hour delivered to consumers' terminals varies considerably according to circumstances, but an average of 5·5 lb. for large and small plants throughout the country will not, I imagine, be very wide of the mark. This would correspond to the consumption of about 2 tons of coal per 800 KW.-hours used by the householder.

Therefore, in allowing 15,000 cb. ft. of gas and 800 units "to count as" 1 ton of fuel, the Controller has to provide the gas and electricity works with about 1·86 tons and about 2 tons of fuel respectively. Reducing these results to the basis of the "effective" heat that the householder may be assumed to obtain from the consumption of 1 ton of coal in his open grates, &c., we find that the Controller would have to provide for gas and electricity works about 2·2 tons and 3·6 tons of coal respectively. These results are summarised in the table in the preceding column.

These figures serve to show that the effective heating of our houses by gas and by electrical energy makes large demands upon our coal resources, and that the authorities have, therefore, good reason for urging the necessity of reducing the consumption of gas and electricity for heating as far as possible during the coming months. The figures indicate further, that, by so doing, the householder will be acting in his own best interests.

THE DUTIES OF THE PROGRESS DEPARTMENT.

BY W. J. HISCOX.

(*Continued from page* 285.)

(*e*) THE PURCHASING DEPARTMENT. (*f*) THE GENERAL STORE.

(*e*) *The Purchasing Department.*—Having dealt with the preliminary departments, the progress man's next consideration is the source of supply, and the Purchasing Department soon demands his attention. The importance of this department, from a progress point of view, varies in many factories, and is determined by the amount and the nature of the material in demand from outside sources. Where the firm possesses a foundry and a smith's shop of such capacity as will ensure an adequate supply of material to meet the demand, the Purchasing Department obviously does not enjoy that degree of importance extended to that department in connection with a factory which cannot maintain itself in the output of rough parts; and it is, therefore, confined to the duties of ordering the necessary raw material to meet the store's requirements, together with finished parts—such as springs, rubber details, &c., which the factory cannot produce.

In the case of a factory which depends to a very large extent on outside firms for the necessary supplies of rough material, as well as for finished parts, the Progress Department must arrange for the early delivery of such parts, in order to allow the machine and fitting shops ample time to perform their operations, and yet ensure the completed unit being dispatched in accordance with programme.

When the specification lists have been received the Progress Department should give the Purchasing Department delivery dates for both rough and finished material, and if, after inquiry, a certain part cannot be delivered by the date given, this information must be promptly given to the Progress Department, together with a report showing what the Purchasing Department proposes to do in the matter, such as instituting inquiries with another firm, with a view to facilitating delivery.

Although there is no necessity for the Progress Department to receive copies of all letters from outside contractors, it is essential that such copies should be received where the letter deals with the question of delivery, together with a copy of the Purchasing Department's reply to any such letter. It is just as necessary for the Progress Department to have the fullest information concerning the delivery prospects of parts from outside sources as for the parts being produced in the factory, and every effort should be made by the Purchasing Department to keep the Progress Department fully posted in all matters affecting delivery.

A works copy of every order placed with outside contractors should be sent to the Progress Department, such copy containing, in addition to the official terms of the order, the works order number, drawing numbers, and other information not generally given to the supplier. These works copies would be filed for reference in the Progress Department, and a list of all material required from outside compiled (if desirable) by the section progress man, for his own convenience. The progress man would issue reminders to the Purchasing Department whenever he con-

sidered there was any likelihood of delay in the delivery of a specific order, and he should be in a position to authorise the sending of a telegram, or even a travelling progress man, to a firm, in connection with matters of supreme importance.

(*f*) *The General Store.*—The practice of treating this department on a different basis to the other factory departments is very common, and is a great mistake. The general store has certain obligations to meet in connection with an order, and these obligations should be fulfilled by the store, without that department having to await the initiative of another department.

The general store should be given a date for the delivery of the parts to be supplied, as in the case of all other departments, and the fullest information should be given on the specification list to enable the store to discharge its liabilities at the earliest possible moment. The size and amount of bar material should be given, and it should not be necessary for the shops to requisition material required in connection with a production order. The receipt of the specification list in the store should be quite sufficient to authorise the issue of material to the departments requiring it.

When there is insufficient stock of a certain part to meet the demand, the Progress Department should be promptly advised, further information relating to the source of supply, and the stock order number in the event of the article in question being produced in the works, being furnished. Upon receipt of this intimation, the Progress Department would at once take the necessary steps to speed up the completion of the required article.

The supply of the necessary rough material in connection with the order, for machining purposes, should be the storekeeper's first consideration, and immediately upon receipt of the specification list he should satisfy himself that an adequate supply of material is available, even if this material is not required immediately. Every shortage should be notified to the Progress Department, the order number affected being quoted, and that department would then get into touch with the Purchasing Department, with a view to urging the suppliers to facilitate delivery.

In a factory where the Receiving Department is controlled by the general store, the storekeeper should arrange for the Progress Department to have each morning a complete list of all goods received the preceding day, full information with regard to the works order number, drawing numbers, &c., being supplied. An entry on the Inwards List to the effect that 50 ft. of special steel has been received does not necessarily suggest to the progress man that this is connected with a number of bushes to various drawing numbers shown on the specification list, and it is the duty of the receiving clerk, therefore, to give on the inwards sheet the drawing numbers and the order number for which any special bar material has been received.

The question of stock orders issued at the instance of the General Store is one which demands the serious consideration of the Progress Department, and in some large concerns a special progress section has been instituted to deal exclusively with such orders. In the case of ordinary stock component parts, the orders are issued by the General Store automatically as the actual stock reaches the official minimum figure, and ordinarily these orders need not trouble the progress man unless the requirements of production orders render his intervention necessary. Where assembled units, such as motor-end shields, collector rings, &c., are stocked, each stock order covering the making of these should be submitted to the Progress Department for a completion date to be affixed, and the order should be treated in the shops in exactly the same manner as a production order.

The progress man should have access to any part or section of the general store, and although he should not interfere with the working arrangements of the store, he should be free to interrogate any charge-hand or person in authority with regard to any specific point in which he is interested. This, if carried out in an amicable manner, will go far to maintain the good relationship between the two departments, and at the same time ensure the material being issued to each shop, to the mutual satisfaction of all the parties concerned.

(To be continued.)

THE ELECTRICITY SUPPLY OF ARCHANGEL.

A description of the electrical installations of Archangel appeared in a recent issue of the *Elektrichestvo*, which says that previously to the year 1914 the population of Archangel amounted to 45,000, and the town possessed three D.C. generating stations, owned by Ya. A. Makaroff, E. K. Plotnikoff, and the Commercial Union. The maximum load of the first was about 200 kw. at 220 volts; the second about 125 kw. at 110 volts, and the third about 100 kw. at 2×110 volts. Thus the total maximum load amounted to about 425 kw.

In the year 1912-13 the further development of these stations was to a certain extent prevented by the great length of the town, and the inadequate capacity of the plant installed. As the development of Archangel proceeded with rapid strides, the town's prosperity promised a greater and greater demand on the stations, which could not be satisfied by the private concerns.

In the year 1913 the Town Council of Archangel decided to construct its own tramways and electricity works, and for this and other requirements raised a loan of 3,000,000 roubles nominal. It was decided to close the private stations.

According to the plan of operations drawn up, it was proposed to begin work in the early spring of 1914, and to complete it some time in 1915. Some preparatory work had been done already in the autumn of 1913, and orders for plant were placed in December of that year. But in the very midst of the work the war broke out, and the completion of the scheme in 1915 became impossible. Besides, the military operations prevented the realisation of the debenture loan that had been authorised. Notwithstanding all the difficulties of the situation, the town did not stop the work; the necessary money for the continuation of the work was obtained by short-term loans, and the private firms were authorised to continue through one more lighting season. In August, 1915, the town finally closed the private stations and started its own supply.

In view of the growth of the town, and the rapidly increasing demand for power, as well as the requirements of the tramways and public lighting, it was estimated that plant of 750-800 kw. would be required to begin with. Having regard also to the contemplated reduction of price, and the extension of the supply to the whole of the town, it was decided to erect a station of 1,000 kw. with provision for future extensions.

A glance at the map of the town (fig. 1) shows the unusual shape of the area of supply, which rendered the adoption of three-phase current at high pressure advisable. The pressure adopted was 3,300 volts at 50 cycles per second.

It was not possible to find a suitable site for the station in the centre of the town, consequently it was erected on land belonging to the Town Council on the bank of the river outside the town. From this position it was easy to carry high-pressure overhead lines through the unpopulated area beyond the Obvodny Canal. Moreover, in immediate proximity to it there is the town water distribution station which facilitates the necessary water supply to the works.

In Archangel coal, firewood, and the waste of the sawmills are used as fuel. Coal is mostly imported from England; the freight previously to the war was very low, as steamers for want of other cargoes brought coal from England as ballast, so that it was possible to have the finest Cardiff coal in Archangel at from 15 to 18 copecks per pood (about £1 per ton). Such a low price for coal left it almost without competitors, particularly for large power installations. In the great swamps surround-

ing the town there are immense reserves of peat, and Archangel itself is half built on peat. All the area beyond the Obvodny Canal, along which the high-pressure line passes, constitutes a continuous peat marsh. To treat the peat specially for such a relatively small installation as the town electricity works would not be feasible, particularly with

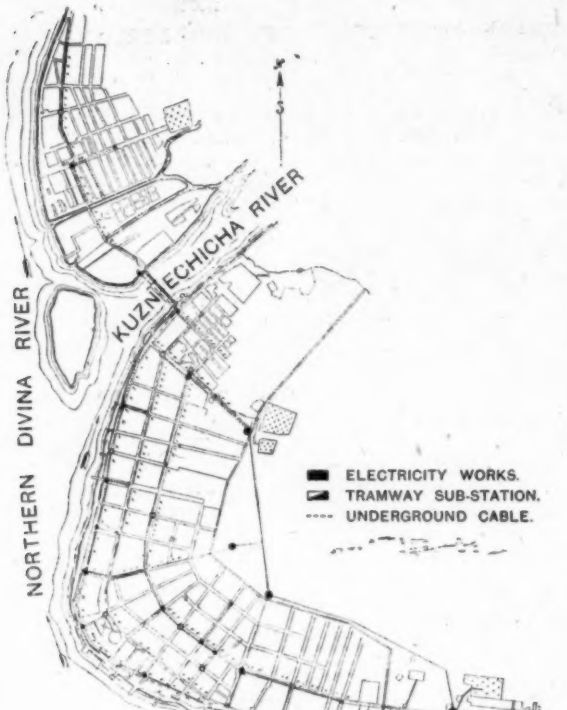

Fig. 1.—Plan of Archangel.

coal so cheap, but no doubt in the future this kind of fuel will take its proper place in Archangel. Under the circumstances coal was selected as the fuel, but lately, in view of the scarcity of coal, the question of preparing peat has assumed fresh interest, and it is possible that the Town Council will begin to work it.

The generating plant was installed in an already existing warehouse. In the boiler room there are two "Harbe" boilers of 225 m². heating surface each, supplemented by Green economisers, with 168 m². heating surface, and Sulzer superheaters of 93 m². heating surface. Each of the boilers can deliver 9,000 kg. of steam per hour. The boilers are fitted with mechanical stokers made by Vibo Vissen, feeding the fuel from below, and with air-cooled furnace bars. Fan draught is employed, and in addition the Schwabach system of exhaust fans has been installed. The fan was chosen with a liberal rating, and takes 34 h.p. The capacity of the exhaust fan is quite sufficient to serve both boilers at once.

Boiler feed is provided for by an electrically-driven pump and a turbo-pump of 30 and 40 h.p. respectively. In order to use the heat of the exhaust steam, a special heater is employed through which part of the feed water passes before reaching the economiser.

As the turbines are fitted with jet condensers, it was necessary to pay particular attention to the quality of the water used for feeding the boilers. The water of the Northern Dwina, because of its hardness, could not be used for boiler feed without preliminary treatment, so a Zeifert water purifying apparatus was provided. In order to reduce the cost of the apparatus as much as possible the boiler water is not obtained direct from the river, but is previously cleaned in the town water system.

In the engine-room three 3-phase turbo-generators were installed, of the impulse type, on the de Laval multiple system, running at 3,000 r.p.m., and rated at 500 kw. each. The guarantees given by the maker, G. Trek, allow for a consumption at full load of 7.3 kg. of steam per kw.-hour, at three-quarter load 7.6, and at half load 8.1 kg., the power factor being unity, and the steam superheated to 300 deg. C., at a pressure of 180 lb. per sq. in., and with a vacuum of not less than 93 per cent. With a power factor of 0.8 the generators develop 625 k.v.a.

The turbo-generators are of the de Laval multiple system (Laval Steam Turbine Works), and differ little from the impulse machines of other makers. The turbines have seven stages, in the first of which a Curtis wheel is used, with four regulating nozzles.

The generators also are of usual construction, and are provided with separate exciters on the shaft ends. Fan cooling is provided, the air being drawn through filters.

Koerting jet condensers are installed, which are able to maintain the vacuum named of 93 per cent. To supply the necessary condensation water from the river two centrifugal electric pumps are installed in the basement, each of which can deal with two turbines at full load. On the river bank a ferro-concrete water collecting and settling pit has been constructed which is connected to the pumps by means of cast-iron pipes. In order that dirty water may not reach the settling pit, a pipe has been laid on the bed of the river, about 50 metres long, and 500 mm. in diameter, through which the water reaches the pit by gravity. The end of this pipe is curved upwards, and is covered by a grating.

As the station is intended for the supply of electricity for both lighting and tramways simultaneously, and the tramway load is very irregular, pressure regulators have been installed. At the time of maximum load, the momentary fluctuations will be not more than 7-8 per cent. of the total

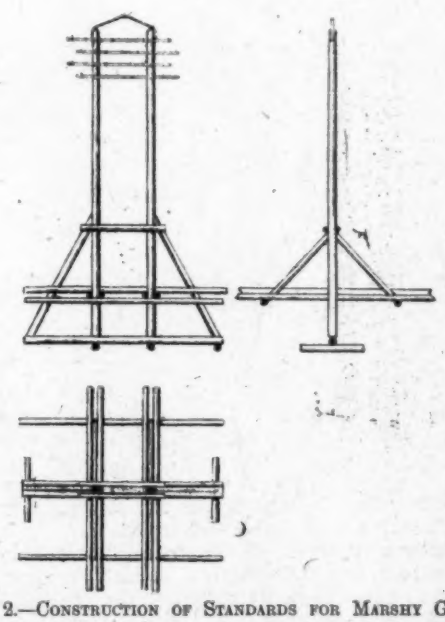

Fig. 2.—Construction of Standards for Marshy Ground.

load of the station, and the pressure regulators may not be necessary, but it will be different at other times when the total load on the station is much smaller, and the relative importance of the tramway load is greater. Hence, two quick-acting automatic pressure regulators, on the Brown-Boveri

system, have been installed, one of them being spare.

The switchboard is of marble, and carries the measuring instruments and the pressure regulators, together with the handles for controlling the oil switches. All the high-pressure apparatus, instrument transformers, oil switches, lightning arresters, &c., are placed in the basement under the distributing board in ferro-concrete cubicles.

An overhead crane, of 10 tons capacity, is provided in the engine room. The electrical equipment of the station was carried out by the Siemens-Schuckert concern.

The high-pressure cables from the central station run underground to a small ferro-concrete kiosk, 9.5 m. in height, containing apparatus for the transfer of six feeder lines (four lighting and two tramway) from underground to overhead. The total number of feeder conductors leaving the kiosk is 18, to which are added eight control conductors, making the total 26. Control conductors are not provided for the tramway sub-station. The conductors are divided over four cross-arms of channel iron of a length of 3 m., fixed to pairs of poles (fig. 2). The upper ends of each pair of poles are connected by an arched support for the steel earthing conductor. The total cross-section of the suspended conductors is about 970 mm². From the overhead high-pressure line, separate feeders branch into the town where necessary.

On account of the great weight of the overhead conductors and the softness of the ground over which the high-pressure line passes, the poles were placed in pairs. The work of fixing these poles was not easy, as the ground beyond the Obvodny Canal is a peat marsh, covered with a water-saturated peat crust of about 1 metre thickness. This peat crust is in places so thin that in setting the poles there were cases of the workmen sinking through. Under the crust there is a semi-liquid mass, the depth of which is from 6 to 8 metres. Under the semi-liquid mass there is solid ground—very probably clay. Only at the central station and the Lutheran Cemetery does the clay outcrop. Thus most of the standards for the high-pressure line had to be placed on marshy ground, and the possibility of employing the usual methods of setting the poles was quite the exception.

In consequence of the great depth at which the firm ground lay, recourse had to be had to fixing the standards in the upper peat crust, a reliable hold in which could only be attained by attaching them to a raft under the surface, consisting of a number of logs bolted together. The function of the frame of logs consists in, first, preventing the standards from settling in the marsh, and, secondly, preventing them from inclining to one side before the wind, or from any other cause. The construction of the framing is shown clearly in fig. 2; for one pair of standards there are used about 15 pieces of 20 to 28-ft. logs, with sides of 5 to 9 in., joined together with bolts and cramps. Since, as shown above, the standards of the high-pressure line are fixed only in the upper peat crust, and, so to speak, float, for the purpose of giving the line greater strength and stability every eighth pair of standards was anchored by four piles, 35 ft. long, sunk to the solid ground, to the upper part of which the logs of the rafts were fixed with bolts.

The distance between the centres of both standards of a pair was 1.75 metres, and the span between pairs of standards 31 to 36 metres. The total number of standards was 114. Besides standards in pairs, eight ordinary standards were installed for branching from the high-pressure line to the transfer kiosk at Byegoff. The total length of the high-pressure overhead line is about 4 km.

Although great storms are rather rare in the North, all the same, for the protection of the overhead high-pressure system from disturbance by atmospheric electricity, due provision was made by installing an earthed conductor over the high-pressure conductors. This conductor served also for earthing the cross-arms of all the standards by means of a vertical iron rod.

TRADE STATISTICS OF SWITZERLAND.

IMPORTS.

The following figures of the imports of electrical and similar goods into Switzerland in the year 1916 are taken from the recently-issued trade statistics; the figures for 1915 are added for purposes of comparison, and notes of increases or decreases are given.

	1915. Francs.	1916. Francs.	Inc. or dec. Francs.
Electric cable not insulated.—			
From Germany	2,000	7,000	+ 5,000
Electric cable insulated with rubber or paper.—			
From Germany	5,000	33,000	+ 28,000
,, Great Britain ...	1,000	92,000	+ 91,000
,, France	4,000	57,000	+ 53,000
,, Italy	142,000	100,000	− 42,000
,, Other countries ...	—	3,000	+ 3,000
Total	152,000	285,000	+ 133,000
Cable ditto covered with lead and iron-armoured.—			
From Germany	53,000	54,000	+ 1,000
Cable insulated with rubber or paper and covered with textiles.—			
From Germany	6,000	1,000	− 5,000
,, Italy	184,000	40,000	− 144,000
,, Great Britain ...	27,000	14,000	− 13,000
,, France	—	52,000	+ 52,000
,, Other countries ...	1,000	7,000	+ 6,000
Total	218,000	114,000	− 104,000
Cable ditto covered with lead.—			
From Germany	—	3,000	+ 3,000
,, Italy	3,000	1,500	− 1,500
Total	3,000	4,500	+ 1,500
Dynamo-electric machines and electric transformers.—			
From Germany	900,000	221,000	− 679,000
,, France	25,000	12,000	− 13,000
,, Italy	12,000	22,000	+ 10,000
,, Great Britain ...	24,000	8,000	− 16,000
,, Other countries ...	4,000	25,000*	+ 21,000
Total	965,000	288,000	− 677,000
* United States 24,000 fcs.			
Accumulators, batteries, electrodes.—			
From Germany	103,000	42,000	− 61,000
,, Italy	29,000	26,000	− 3,000
,, France	10,000	5,000	− 5,000
,, Other countries ...	3,000	27,000	+ 24,000
Total	145,000	100,000	− 45,000
Insulators, mounted.—			
From Germany	33,000	32,000	− 1,000
,, France	1,000	1,000	—
Total	34,000	33,000	− 1,000
Electric meters.—			
From Germany	873,000	895,000	+ 22,000
,, France	111,000	40,000	− 71,000
,, Italy	7,000	—	− 7,000
,, Great Britain ...	3,000	—	− 3,000
,, Other countries ...	4,000	8,000*	+ 4,000
Total	998,000	943,000	− 55,000
* United States 5,000 fcs.			
Telegraph and telephone apparatus.—			
From Germany	191,000	443,000	+ 252,000
,, Belgium	35,000	—	− 35,000
,, Great Britain ...	45,000	292,000	+ 247,000
,, Sweden	58,000	1,000	− 57,000
,, Other countries ...	20,000	70,000*	+ 50,000
Total	349,000	806,000	+ 457,000
* United States 30,000 fcs.			

EXPORTS.

The following figures show the exports of electrical and similar machinery from Switzerland in 1916 compared with 1915. The diversity of Switzerland's growing export trade is noteworthy:—

	1915. Francs.	1916. Francs.	Inc. or dec. Francs.
Accumulators, batteries, electrodes.—			
To Germany	21,000	6,000	− 15,000
,, France	539,000	665,000	+ 126,000
,, Italy	140,000	69,000	− 71,000
,, Greece	25,000	41,000	+ 16,000
,, Egypt	—	7,000	+ 7,000
,, Brazil	—	14,000	+ 14,000
,, Other countries ...	93,000	329,000*	+ 236,000
Total	818,000	1,131,000	+ 313,000
Steam engines, cranes, pumps, turbines, &c.—			
To Germany	1,515,000	1,406,000	− 109,000
,, France	755,000	2,325,000	+ 1,570,000
,, Belgium	17,000	38,000	+ 21,000
,, Russia	1,189,000	2,563,000	+ 1,374,000
,, British India	131,000	45,000	− 86,000
,, Japan	21,000	310,000	+ 289,000
,, Great Britain	648,000	168,000	− 480,000
,, Spain	372,000	636,000	+ 264,000
,, Other countries ...	814,000*	1,296,000†	+ 482,000
Total	5,462,000	8,787,000	+ 3,325,000
Dynamo-electric machines and electric transformers of all kinds.—			
To Germany	2,998,000	4,904,000	+ 1,906,000
,, Austria	893,000	1,368,000	+ 475,000
,, France	3,523,000	6,881,000	+ 3,358,000
,, Italy	1,089,000	873,000	− 216,000
,, Belgium	35,000	152,000	+ 117,000
,, Great Britain	1,798,000	642,000	− 1,156,000
,, Russia	843,000	1,578,000	+ 735,000
,, Spain	1,204,000	2,217,000	+ 1,013,000
,, British India	201,000	44,000	− 157,000
,, Brazil	102,000	872,000	+ 770,000
,, Argentina	982,000	331,000	− 651,000
,, Netherlands	497,000	1,427,000	+ 930,000
,, Norway	611,000	180,000	− 431,000
,, Other countries ...	470,000	1,170,000*	+ 700,000
Total	15,246,000	22,639,000	+ 7,393,000
Electric meters.—			
To Germany	803,000	793,000	− 10,000
,, Austria-Hungary ...	118,000	176,000	+ 58,000
,, France	155,000	348,000	+ 193,000
,, Italy	373,000	959,000	+ 586,000
,, Great Britain	387,000	402,000	+ 15,000
,, Russia	400,000	417,000	+ 17,000
,, Spain	150,000	174,000	+ 24,000
,, Japan	153,000	361,000	+ 208,000
,, Other countries ...	365,000	674,000*	+ 309,000
Total	2,904,000	4,304,000	+ 1,400,000
Steam, benzine, and electric locomotives.—*			
To France	68,000	654,000	+ 586,000
,, Austria-Hungary ...	—	1,113,000	+ 1,113,000
,, Dutch East Indies ...	385,000	—	− 385,000
,, Other countries ...	387,000†	887,000‡	+ 500,000
Total	840,000	2,654,000	+ 1,814,000
Electric cable, not insulated.—			
To Germany	1,000	8,000	+ 7,000
,, Italy	—	2,000	+ 2,000
,, Other countries ...	300	1,000	+ 700
Total	1,300	11,000	+ 9,700
Electric cable, insulated with rubber or paper.—			
To Germany	135,000	2,000	− 133,000
,, France	4,000	6,000	+ 2,000
,, Italy	—	15,000	+ 15,000
,, Roumania	11,000	28,000	+ 17,000
,, Other countries ...	9,000*	1,000	− 8,000
Total	159,000	52,000	− 107,000
Cable, ditto, covered with lead.—			
To Germany	1,000	500	− 500
,, Great Britain	158,000	108,000	− 50,000
,, Other countries ...	—	500	+ 500
Total	159,000	109,000	− 50,000
Cables, ditto, covered with lead and iron armoured.—			
To Germany	23,000	123,000	+ 100,000
,, Great Britain	12,000	—	− 12,000
,, France	—	8,000	+ 8,000
,, Egypt	7,000	—	− 7,000
,, Argentina	—	94,000	+ 94,000
,, Other countries ...	—	12,000	+ 12,000
Total	42,000	237,000	+ 195,000
Cable, insulated with rubber or paper, and covered with textiles.—			
To Germany	69,000	66,000	− 3,000
,, France	—	4,000	+ 4,000
,, Italy	—	17,000	+ 17,000
,, Great Britain	8,000	—	− 8,000
,, Other countries ...	10,000	14,000	+ 4,000
Total	87,000	101,000	+ 14,000
Cable, ditto, covered with lead.—			
To Germany	2,000	2,000	—

* Russia 53,000 fcs.

* Sweden 127,000 fcs., Chile 192,000 fcs.
† China 269,000 fcs.

* Portugal 147,000 fcs., Dutch Indies 370,000 fcs.

* Includes Australia 247,000 fcs.

* Electric locos. in 1916, 23,000 fcs.; in 1915, 11,000 fcs.
† Includes Philippines 113,000 fcs.
‡ Includes Italy 571,000 fcs.

* Greece 8,000 fcs.

Note.—25 francs = £1.

WAR ITEMS.

Letters from France.—A Captain in the R.A.F., writing from France, says:—

"Many thanks for Review, which is as regular as it is welcome. The articles on future problems are particularly interesting, and it is very refreshing to note the clear underlying implication, in some of the statements, that some earnest endeavour will be made to restore personal, as well as material, values after the war. That possibility has been a sheet-anchor to many of us."

The Female Car-Drivers of Paris.—In the course of a recent article entitled "The Week in Paris," a *Times* correspondent says:—

"As all know, the women of the people in France have replaced the men most admirably, and an article in the *Victoire* gives a clear account of how the Parisian women have proved capable tramway drivers. They learn their job as quickly as the men, and there have been no more accidents registered by the company since there have been wattwomen than there used to be when there were only wattmen. Wattwomen must be strong, as they drive 10 hours a day, and during those hours they are obliged to stand all the time; nerves must be solid, and hands that work the brakes must be muscular. The most perfect self-control is necessary. To learn the working of a tramway-car with underground and overhead systems, and the rules of driving, takes a month; after that the women act as ticket-punchers for a week or two, thereby learning the necessary collaboration with the driver in the matter of giving the current at different points of the line and the various ways of signalling danger, as well as of calling the stops. The drivers earn 5f. 50c. a day, with 5f. extra for high cost of living, and added to this they are entitled to several prizes for expert work and regular supplements every three and six months. On arriving at the depôt in the morning, they find their work sheet all ready. Some do their 10 hours' work straight off with only an hour and 10 minutes stop for their mid-day meal, others who do the early morning and late night work, get five hours rest in the day. The two reproaches brought against the women as workers in the broad sense are that they allow personal feelings to interfere too often and upset the harmony of the work by refusing to go on duty with women they do not like, and that they stay away from their work for the most trivial reasons, in their own slang, *pour se chauffer*."

The New List of Certified Occupations.—With reference to our extracts from the above list in our last issue, it must be borne in mind that the inclusion of a man in the list does not in itself exempt him from military service. His case will be heard by a Tribunal in the ordinary way, but the Tribunal will be guided by the fact that the applicant is included in the list, and the National Service representative will only in very exceptional circumstances oppose his exemption. The list is confined to questions of exemptions coming before Tribunals. It is announced in various newspapers that the position of men of the new military age, whose occupations are in the list, is not affected, the current instruction still holding good that they are not required at present to undergo medical examination. If they receive notices they should be returned.

The Training of Disabled Soldiers in Germany.—The Electrotechnical Training School of the Physical Society of Frankfort-on-Main reports that the managers in 1917-18 devoted their efforts exclusively to the training and improvement of disabled soldiers belonging to the electrical trades. Funds have been placed at the disposal of the school privately, and the instruction, which averages seven months, is given free of charge.

Pensions of Discharged Men.—The Ministry of Munitions has circulated for use as a poster in munitions workshops, a statement by the Minister of Pensions regarding the position of discharged soldiers and sailors as wage-earners. He says that an impression seems to exist that men by working full time and earning increased wages will by such means cause a reduction in their pension. He points out that whatever a man may earn, it will in no way interfere with his permanent pension, and that where a temporary pension has been granted, the earning capacity of the man will not in any way determine the amount of his pension, which will be reassessed solely on the degree of his physical disablement. A man need not answer any questions as regards his employment or the amount of his earnings when being examined before a medical board.

Exemption Applications.—The Hull Appeal Tribunal had under consideration the case of an employé of the city engineer's department, a Grade 1 man, 28 years of age, an electrician and electrical fitter. According to the *Eastern Morning News*, the notice of appeal urged that the local Tribunal did not give special consideration to the character of the employment, and the appellant's fitness for it. The local Tribunal, on the other hand, intimated that they were of opinion the appellant should be made available for Army service. They did not consider, after four years of war, that they were justified in granting further exemption to a man of his age and grade, and they were of opinion that the Corporation would be able to arrange for another man to do the work. For the department, it was said that it was a special case. The city engineer had always resisted any application made to him to appeal for men, but in that case he had no alternative. The man's duties were entirely in connection with public institutions and public utility services, and they had been unable to make any other provision for carrying on his work. He looked after the electrical machinery in the city engineer's department, including four automatic sewage pumping plants, two electrically-driven bridges over the river Hull, the fire brigade alarm calls, intercommunication telephones at the city hospital, Evan Fraser Hospital, small-pox hospital, and tuberculosis sanatorium, sewage pumps at the V.A.D. hospital, the fire alarms at the Willerby Asylum, and the hospitals, the tramway junctions, bridge signals, the electric crane at the pier, the tramway welding plant, the city hall fans and electric lighting, the Guildhall fans and lifts, &c. Before the war they had seven men in the department, but now they had only appellant and one substitute. The Tribunal allowed four months' exemption, the chairman remarking that they would be able to see what the military situation was at the end of that period, and whether the Corporation had been able to get a man in his place.

Before the Stratford-on-Avon rural Tribunal, Mr. C. T. Garland appealed for the retention of G. E. Evemy (44, Grade 2, B2), electrician, engaged in supplying electricity to farms and houses at Moreton Morrell. It was stated that the man, who had served in the Army, had taken the place of a man who had gone on munitions, and that there was no one to replace him. The National Service representative suggested that with his knowledge of electricity Evemy would be exceedingly useful in the Flying Corps. Six months were conceded.

At Broadstairs, the Isle of Thanet Tramway & Lighting Co. appealed for two employés, one aged 38 and B1, and the other 42, Grade 3. Each was granted three months on the ground that they were employed on work of national importance.

Hereford Tribunal has granted exemption until March 1st to W. Preece (42, Grade 3), electrician with Messrs. Daffern and Edwards.

Dorset Appeal Court has granted six months' temporary exemption to T. H. Escott (32), electrician with Messrs. Brooking & Co., electrical engineers.

Littleborough Tribunal has granted six months' exemption to E. S. Nuttall (Grade 3), electrician, appealed for by the Sladen Wood Mill Co.

At Chatham, the Tramway Co. appealed for five employés. It was stated that one of the men (30, Grade 1) had been substituted. He was refused exemption, and the others were each granted three months.

Cambridge Tribunal has granted temporary exemption to W. Maskell (48, Grade 2, B2), electrical engineer in charge of the University power station.

Electrical Imports into Spain.—The imports of dynamos and electric motors into Spain during the first four months of the current year only attained a value of £89,280, as compared with £126,760 in the corresponding period of 1917. There was also a marked decrease in the imports of electric cable and wire—from £6,480 to £1,120.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Falk, Stadelmann & Co., Ltd.

I notice certain notes with regard to Falk, Stadelmann & Co. in your issue of this week, wherein you say that the business was incorporated as a company in 1887, and practically the whole of the capital from its inception has been held by British subjects.

I enclose you an excerpt from the records at Somerset House, which, if you can find room to publish it, will leave your readers in a position to judge which of the two statements—that of *John Bull* in your previous issue, or the mention in your last issue—be the correct one.

I think it is the duty of the electrical Press to make these matters as plain as possible, and trust you will find room for this letter and the excerpt enclosed.

An English Manufacturer.

[COPY.]

FALK, STADELMANN & CO., LTD.

Incorporated June 8th, 1887, to take over and carry into effect an agreement between SOLOMON FALK and MONTZ and BERNARD THURNAUER.

Directors. — Max Falk, 11, Fitzjohn Avenue, N.W.
Louis Thurnauer, 23, Pembridge Crescent, W.
Victor Falk, 5, Lancaster Place, N.W.
Gustav Falk, 19, Fawley Road, N.W.

Capital.—Issued for cash, £239,460, and for other consideration, £153,330. Value, £392,790.

Chief shareholders.	Mrs. Zerlina Falk, Albert Pappenheimer, Max Falk — Joint holding ...	£95,470
	Bernard Thurnauer, Nuremberg	77,447
	Victor Falk	51,294
	Max Falk	51,294
	Louis Thurnauer	88,133
	Jacob Friedmann	2,200
	Gustav Falk	1,500
	Hugo Falk	1,000
	Pauline Israel, Hochburg	1,000
	Victor Falk, Zerlina Falk, A. Pappenheimer — Joint holding. ...	10,000
	Victor Falk, Max Falk — "	3,000
	Zerlina Falk	6,482
	Victor Falk, Felix Rose	2,500

[Agreeing with "An English Manufacturer" that the matter should be made as plain as possible, and in order to avoid delay, we adopted the plan, not unusual in such cases, of forwarding a proof of the letter to the company named for its observations.

As a result, we are given to understand that the excerpt given above, in substance correctly records—although not so in minor detail—the return made three years ago. It is not considered to affect the statement made in our last issue. The present shareholders are all British subjects, and no shares are enemy-held. The holding of £77,447 by Mr. Bernard Thurnauer has, as mentioned last week, been acquired by the company. This holding, which was criticised in the article originally quoted as having been taken over, consisted of £28,080 Ordinary Shares and £49,367 5 per cent. Preference Shares. The Preference shares carry no voting power, and, therefore, have no control in the affairs of the company, while the ordinary shareholding, as will be seen, amounted to approximately 7 per cent. only of the total issued capital—viz., £392,790. The holding which is described as "Chief Shareholders" represents a Trust created under the will of the late Mr. S. Falk, the founder of the company. Mr. S. Falk settled in this country in the year 1875, when he was 21 years of age. He was a British subject; he was naturalised 30 years ago. The other shareholders—so far as they are not British-born—have likewise been naturalised for periods varying from 20 to 26 years, they having resided in this country from 30 to 36 years. The only exception is that of two younger members, having a nominal holding. They were denationalised before they were 18 years of age, and have been naturalised for some years.

It is, perhaps, irrelevant, but yet it is only right that it should be known, that the chairman of the company has two sons, born here, holding commissions in His Majesty's Army, and that they are on active service overseas. The only one then of eligible age volunteered for service before the Military Service Acts came into force.—EDS. E.R.]

Ozone in the Treatment of Wounds.

I notice in the account of the exhibits at the British Scientific Products Exhibition an account of an ozoniser for which certain wonderful and special claims are made. I am not so much concerned with this as with the manner in which the statement is worded, and which, if read by the ordinary reader, without special knowledge of the subject, is likely to mislead him.

In the first place, the opening statement that the brush discharge attacks the nitrogen, breaking much of it into nitrous compounds, is not the fact. Any ozone apparatus which performs this feat by means of the brush discharge would have to be specially designed for the purpose, because any ordinary ozone apparatus of the type described—that is, working with a silent discharge—could only produce a very fractional percentage of nitrogen compounds under the worst conditions. As a matter of fact, the apparatus manufactured by my company was submitted 12 years ago to a very searching investigation by a well-known consulting chemist and public analyst (an authority which I consider to be the only correct one for the purpose named), with the result that, even at high concentrations, no trace of nitrogen compounds was found.

The use of ozone for surgical and therapeutic treatment was not general in this country from the fact that its use for the purpose was doubted, so far as efficacy was concerned, and not from any question of nitrogen compounds, because it was always a simple matter, even if those compounds had been formed, to eliminate them.

Like all these matters in this country, it was left to the inventors of the apparatus to prove its value, and for the last 12 or more years I have been engaged on that work.

My company has supplied a very large number of apparatus, not only for the purpose mentioned in your notice of September 20th, but for many other therapeutic uses, and these apparatus have always been supplied under medical supervision.

The ozoniser in question, we understand, makes use of ordinary air as an ozonising medium. There is a great objection on the part of many who are best able to judge that the use of ozone under such circumstances is not as good or advisable, certainly for the treatment of suppurating wounds and sinuses, as ozone when made from oxygen. The reasons are too obvious to need discussion, and I, personally, should refuse to supply such an apparatus, as I have done on several occasions. It is true that it has the merit of cheapness and it obviates the necessity of the use of oxygen in cylinders, but the other disadvantages for the purpose mentioned are too obvious to need a comparison on the question of cost or convenience.

With regard to the point of ionisation—this point is common to any ozone apparatus using the brush or silent discharge.

As to the tests having shown a large increase of ozone produced by the apparatus in question over other methods, it would have been to the point if details of the comparison had been given. When I am able to tell you that an apparatus of my own invention some eight or nine years ago, which is still being supplied by my company in its original form, takes only some 6 or 8 watts to work it, you will realise that any comparison of efficiency as regards yield of ozone per kilowatt is a little bit out of place; and, in fact, I doubt very much whether any reliable comparison could be made, or, if made, would be of any value whatever.

The apparatus in question will, for the 6 or 8 watts, produce considerably more ozone than is likely to be necessary to be used on the worst case of suppurating wound.

Edward L. Joseph,
Director and General Manager, Ozonair, Ltd.

London, S.W.,
September 24th, 1918.

The Electrical Trades Union and Discharged Soldiers.

A correspondent sends us the following cutting from *John Bull* for September 14th :—

Intimidation.—A discharged soldier got employment under the Minister of Pensions as an electrician—his old trade. Sent to Chilwell, on arrival he was asked whether he belonged to the Electrical Trade Union. He did not—having lived 20 miles distant from any branch—but was quite willing to join, and paid 2s. 6d. proposition fee. Next day he was told he must be a member of the Union for three months before the men would work with him, and he had to leave at a moment's notice. It is difficult fitly to describe such treatment.

Our correspondent thinks that the extract will be of interest to readers of the Review. He considers that it will appeal "to any right, fair, just, and ordinary reasonable individual, but in these qualities, not to mention human sympathy, the Union is evidently lacking." He says that the action described reflects utter discredit upon members and officials alike, and that the concluding comment of *John Bull* is apt and right. He adds that "it is up to the duty, honour, and manhood of this Union to rectify and prevent any further occurrences" of the kind referred to.

The Percentage Error.

Mr. Bullen's article on percentage error is correct as far as it goes, but where more than one percentage is considered—as in the case of the potential transformers and current transformers of the meters—the subtractions lead to complications, and, as shown a short time ago in the case of complicated discounts, calculations involving additions and subtractions lead to error if not taken in the correct order.

To get over this, the best way is to give the "efficiency" of the meters or apparatus. The case given by Mr. Bullen would be 140 per cent. efficiency. Now it is a simple slide-rule calculation to work out: True units = 100 × (observed units/efficiency), therefore: Units for quarter = 100 × (400/140) = 287.

By this method, if the potential transformers had been given as 101 per cent. and the current as 98·5 per cent., the calculations are mple, and only a slide-rule need be used.

W. J. Minton.

London, N.W., *September 17th*, 1918.

LEGAL.

Factory Act Prosecution.

At Newcastle-upon-Tyne Police Court, on the 20th inst., Messrs. Swan, Hunter & Wigham Richardson, Ltd., were charged under the Factory Act with having failed to take adequate precautions properly to earth an electrically-driven punching machine at their Neptune shipyard, Walker-on-Tyne, and with having failed to protect the live cables.

Mr. W. B. Lauder, H.M. Inspector of Factories, stated that on August 2nd Samuel Dunbavin, aged 17, received an electric shock while working at the machine, and was killed. The machine had become charged with electricity owing to the insulating wrapping of the cable becoming bared and touching the top of the compensator. Had the machine been properly earthed it would not have become so charged.

Mr. H. Ingledew, on behalf of the defendant company, said the machine was overhauled in June, and it appeared to be quite in order. The machine had been worked night and day, and owing to the excessive vibration and the shortage of labour (half of the electricians having been taken away), the earthing wire had probably worked loose. No one regretted the accident more than did his clients.

The Magistrates imposed penalties of £50 and £5.

Lighting Order Prosecution.

At Rochdale, last week, the Rochdale Electric Co., Ltd., was summoned under the Lighting, Heating, and Power Order, 1918, for unlawfully using lights in its shop front. The Chief Constable pointed out that under the Order, which was made in April last, it was not permissible to have an artificial light of any description in either a shop window or shop front. The Order was quite distinct from the Light Restriction Order. A fine of 5s. was imposed.

BUSINESS NOTES.

Trading with the Enemy.—The *London Gazette* for September 20th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Brazil, Chile, Denmark, Greece, Mexico, Morocco, Netherlands, Netherlands East Indies, Spain, and Sweden.

Co-operative Export Trade Expansion.—At a meeting held in Manchester, last week, it was resolved to proceed with the formation of a British Manufacturers' Corporation for After-the-War Trade, as suggested by Sir Charles Mandleberg, whose proposals have been fully described in our pages. It is stated that 300 firms have already given their support, and it is expected that the number will reach 1,000 after the Corporation is established. A Provisional Committee has been appointed, with Sir C. Mandleberg as chairman. An annual subscription of £200 per member is mentioned.

New Canadian Industries.—Our Special Correspondent in Canada writes:—"The *Canadian Chemical Journal* for July gives some particulars regarding the industries which are springing up around the Shawinigan Falls, near Montreal.

"Canadian Ferro Alloys, Ltd., will have six furnaces of a daily capacity of 17 tons of ferro alloys each.

"The Canadian Aloxite Co. has 14 furnaces employed in turning out abrasives.

"The Canada Carbide Co., the Canadian Electrode Co., and the Canadian Electro Products Co. are other firms taking power from this source.

"Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, announced a few weeks ago that the Provisional Government had authorised the development of 130,000 H.P. at Nipigon, in New Ontario, which is in the north-western portion of the Province. There are great mineral resources in that region, and it is with the object of enabling these to be developed that the authorisation has been granted. Survey work is already being carried out in connection with this scheme by the Commission. The development of some 25,000 H.P. at High Falls, on the Rideau River, not very far from Ottawa, has also been approved of. The Power Committee of the House of Representatives at Washington has been informed that at the end of 1919 the Hydro-Electric Power Commission will be able to supply the United States with 200,000 H.P., to be increased by 30,000 H.P. per month until 300,000 H.P. is reached.

"From 75 to 80 per cent. of the power at present being supplied by the Commission, which amounts to about 200,000 H.P. altogether, is used in the production of munitions, and, to enable this great demand to be met, cities have had to cut down their lighting loads and generally to economise in other ways; for instance, 12,000 H.P. has been set free in Toronto alone, so that the supply for munitions purposes might be met."

Trade Announcement.—The Export Sales Department of the Western Electric Co., Ltd., has been removed to offices at Oswaldestre House, Norfolk Street, W.C. 2. (Tel.: City 3400.)

Non-Ferrous Metal Industry Act.—The *London Gazette* for September 24th contains a further list of licences granted under this Act.

Catalogues.—Messrs. Siemens Bros. & Co., Ltd., Palace Place Mansions, Kensington Court, London, W. 8.—Pamphlet, No. V 535, of 12 pages, containing a full account, with diagrams and half-tones, of the Siemens vacuum arrester for the protection of telegraph and telephone installations and their users against H.T. discharges.

Book Notices.—We have received a copy of the first number of the *Industrial League Journal* (September, 6d.), which is to be issued quarterly, for furthering the work of the Industrial League (56, Victoria Street, S.W.). There is a "Foreword," by Mr. G. H. Roberts, M.P., Minister of Labour, who is a member of the League Executive, and the other contents include a report of proceedings in connection with the formation of the Bradford District Branch last May; an article by Mr. H. G. Williams on "The Need and Possibilities of Increased Production;" and a full report of the first of a series of conferences (on the subject of Workshop Committees) held at Westminster in April. Copies of the *Journal*, and of other literature of the League, are available for general distribution.

"The Central" for June contains a portrait and memoir, by Prof. Dalby, of Sir John Wolfe Barry, the late chairman of the Delegacy; there is also an article on "The Organisation of the Technical Worker," and the remainder of the issue consists of "Old Student Notes."

"A Small Book on Electric Motors, C.C. and A.C." By W. Perren Maycock. Pp. ix. + 192; 128 figs. London: Sir Isaac Pitman and Sons, Ltd. Price 5s. net.

"Modern Engineering Measuring Tools." By Ernest Pull. Pp. viii + 115; 110 figs. London: Crosby Lockwood & Son. Price 4s. 6d. net.

A Barcelona Lamp Company.—The Barcelona company styled "Wolfram, Fabrica de Lamparas Electricas, S.A.," has changed its name to "Fabricacion Nacional de Lamparas Electricas, S.A.," increasing at the same time its capital to 1,000,000 pesetas. Its managing director bears the cognomen of Mauricio (Mauritz) Grisau.

U.S. Trade in South America.—The *Times* Buenos Aires correspondent says that the United States is preparing for trade expansion after the war, and elaborate plans have been made to increase the Consular Service in South America. The most experienced officers will be assigned to these posts, and the number of Consulates in Argentina and Chile will probably be doubled.

Bankruptcy Proceedings.—William T. Smith, electrical and mechanical engineer, Bolton.—The adjourned examination of this debtor was down for September 18th, at the Court House, Mawdsley Street, Bolton, but the case was again formally adjourned.

Brockie, James, mechanical engineer, 41, London Road, Forest Hill, Kent.—Application for discharge to be heard at Greenwich, October 18th.

Exhibition of "Key" Industries.—By permission of the Ministry of Munitions, an Exhibition of New British and "Key" Industries, organised by the Industrial Section of the Tariff Reform League, will be held at the Central Hall, Westminster, London, next month. The Exhibition will be opened, by ticket only, on Monday, October 7th, and to the general public, admission free, on and after Tuesday, October 8th. It will remain open until October 22nd, after which it will be shown in Manchester and other leading provincial centres of population. The object of the Exhibition is to illustrate the facts respecting the more important of the so-called "key" or "pivotal" industries recommended for special treatment by the Government Committee on Industrial and Commercial Policy after the War. The Committee has secured the active co-operation and assistance of important firms interested in the industries concerned, many of whom have contributed exhibits and expert information. Any reader interested in the matter should communicate with Mr. Edward J. Duveen, chairman of the Industrial Section, Tariff Reform League, 7, Victoria Street, London, S.W. 1.

LIGHTING AND POWER NOTES.

Barnes.—Proposed Loan.—The U.D.C. has applied to the L.G.B. for a loan of £1,220, for electrical extensions to the refuse destructor.

Belfast.—New Generating Station.—Last week members of the Corporation, Sir John Snell, and Mr. J. H. Rider, consulting engineers, and officials of the Harbour Board paid a visit to the site of the new generating station at Queen's Road, where luncheon was served. Having outlined the history of the electricity undertaking, the chairman said the question of coal economy was involved in the development of the department. The East Bridge Street station contained 20 generating sets, which were out of date, and the silting-up of the Lagan interfered with condensation. It was estimated that the coal consumption at the new station would be less than 2¼ lb. per unit, compared with 4¼ lb. at East Bridge Street. Sir John Snell said the new station was being laid out to house 25,000-kw. generators. The chairman of the Harbour Board said he hoped that eventually the Corporation would have to spend one million pounds on developments.

The E.L. Committee has recommended the Corporation to accept tenders, amounting to £200,000, for plant in connection with the new generating station.

Blackburn.—Year's Working.—The annual report states that there was a profit of £4,472 on the Corporation electricity undertaking for the past year.

Chatham.—Price Increase.—The Kent E.P. Co. has increased its charges for electricity as follows:—For power, to 2¼d. per unit; lighting, from 6d. to 8d. per unit; for supply by contract for power, and weekly, monthly, and special accounts for lighting, by 20 per cent.

Dublin.—Fuel Shortage.—A consultation between the Dublin Industrial Development Association, the E.L. Committee, and the Irish Coal Controller has resulted in the following proposals for economy in lighting. If the proposals are adopted the Controller has agreed to supply enough coal to carry them into effect, even if he has to commandeer it from other sources. The proposals include the closing of shops at 5 p.m., or, alternatively, to close between 3.30 and 5.30, and to remain open until 9.30 p.m.; offices to close at 4 p.m.; private houses to be rationed as follows:—1, 2 or 3 rooms, 110 units per annum; 4-6 rooms, 160; 7-9 rooms, 210; over 9 rooms, 250 units, or two-thirds of the supply in 1914; theatres to close by 10.30 p.m.; picture theatres to close between 3.30 and 5.30; out-door theatre lighting to be prohibited, and the total lighting to be reduced by 25 per cent. compared with 1914; factories to have preference for energy for power purposes, but factory lighting is not to be more than 80 per cent. of the pre-war lighting. It was stated that the contractor would not enter into any contracts for coal this year, owing to the critical position.

Similar proposals to those made at Dublin for economy in lighting were made at a special meeting of the Belfast Corporation last week.

Falkirk.—Mains Extensions.—Subject to sanction being obtained, the E.L. Committee has decided to borrow £5,000 for the purpose of extending the mains at Pleasance, and to accept the tender of Callender's Cable and Construction Co. for the work.

Ireland.—Water Power.—Mr. W. Vaux Graham, of Queen Anne's Gate, S.W., has been instructed by the Water Power Committee of the B. of T. to examine and report on the available water power in Ireland, and its possibilities in relation to production of electricity, peat fuel, &c.

Leighton Buzzard.—Proposed Electricity Supply.—The U.D.C. has been informed by the Luton T.C. that there is no immediate prospect of electricity being supplied within the area of the U.D.C., but the matter will be considered later.

London.—Price Increase.—The City of London E.L. Co. has substituted the following for its present charges, the advance to take place from the end of September:—Lighting, 5d. per unit; heating, 1½d.; power 1d., plus 10s. per quarter per kw. capacity of the connected demand; all charges are subject to 60 per cent. war increase.

Hackney.—E.L. Surplus.—Of the surplus on the B.C. electricity department, amounting to £10,913, £7,327 is to be transferred to the relief of rates and £3,586 to the reserve fund for the repairs necessary at the generating station.

Hammersmith.—In recommending the B.C. to purchase three 111-microfarad condensers, at a cost of £1,875, the E.L. Committee states that one static condenser was put into commission at the Cottage sub-station, as an experiment, at the end of July last, and has been in continual operation since then. The engineer reported that tests had proved this method of meeting the difficulty of extensions to be not only feasible but economical, it having effected a saving of 18 units per hour. It would also be an advantage to have a condenser of this type on hand for rectifying the low power factor frequently obtained on consumers' premises with a motor load in another part of the district, and so temporarily obviate the necessity of laying new mains.

Londonderry.—Street Lighting.—The Corporation has adopted a scheme for the conversion of 184 lamps to one-third of their original power, or 100-c.p. for each lamp.

Lowestoft.—Price Increase.—The T.C. has advanced the charges for electricity by 1d. per unit for lighting and by 10 per cent. for power.

Maidstone.—Wages.—The application of the electricity works employés for a war bonus of £1 per week, plus 12½ per cent. on total earnings, has been granted by the Arbitrator appointed by the Chief Industrial Commissioner. The award is to date from June 1st, 1918. The members of the E.T.U. have asked for a further 3s. 6d. per week on the award of the Committee on Production.

Middlesbrough.—Electricity in Shipyards.—The Corporation has decided to supply electricity to the shipyards of Sir Raylton Dixon & Co., on Tees-Side. The cost of the mains, transformers and switchgear is estimated at £10,000. Under this scheme half a million units per month will be supplied, and also all the energy required for extensions at Cleveland Dockyard for some years to come.

Mytholmroyd.—Prov. Order.—The U.D.C. has had under consideration applications from the Electrical Distribution of Yorkshire, Ltd., and the Halifax Corporation for a prov. order

for the supply of electricity within the area of the U.D.C. It was decided to oppose the application of the E.D. of Y. Co., and to consent to that of the Halifax Corporation.

Melksham.—Price Increase.—The E.L. Co. has notified the U.D.C. of its intention to advance the price of electricity from 8d. to 9d. per unit.

Rotherham.—Purchase.—The Corporation has purchased the E.L. undertaking of the Mexborough and Swinton Tramways Co. for £45,000. The date of the transfer is fixed for October 1st.

South Africa. — Johannesburg. — The Council has arranged to supply electricity to the Star Milling Co. and the stone-crushing works of Mr. G. S. Stowe at 1½d. per unit for a minimum of 100,000 units per annum; the supply is not to be taken between 5 p.m. and 11 p.m.

Swansea. — Mains Extensions. — Messrs. Richard Thomas & Co. propose to lay mains for the supply of electricity to their Cwmbwrla and Cwmfelin steel works. The Corporation is extending its supply to the Landore foundry, at a cost of £350, and to the Morriston foundry, at a cost of £385.

Tewkesbury.—Proposed Price Increase.—The E.L. Co. has applied to the B. of T. for permission to advance the maximum price of electricity to 10d. per unit, but will not charge more than 8½d. without the sanction of the T.C.

United States.—Water-Power Development.—The *Electrical World* states that last year about 1,058,000 H.P. of hydro-electric plant was built and installed, representing a saving of 8½ million tons of coal and a corresponding amount of labour, production, and transport.

Weybridge.—Price Increase.—The U.D.C. has decided to oppose the application of the E.L. Co. for permission to increase the price of electricity from 7d. to 8d. per unit, on the ground that when the charge was advanced to 7d. the company promised to ask for no more during the year.

Willesden.—Price Increase.—The E.C. has recommended that the charges for electricity be advanced by an additional 10 per cent., and by 2d. in the 1s. in the case of supply by slot meter.

Access to Meters.—In cases where the electricity department has been unable to obtain access to meters, the Committee has decided to charge a minimum of 13s. 4d. per quarter.

TRAMWAY AND RAILWAY NOTES.

Continental.—Switzerland.—The receipts of the 35 Swiss tramway companies fell in 1914 and 1915 to 16,000,000 fr. (£640,000), but in 1916 they rose to 19,000,000 fr. (£760,000), and in 1917 to nearly 23,000,0000 fr. (£920,000). The profits for 1917 were 4,500,000 fr. (£180,000), as compared with the 1913 profits of 3,500,000 fr.

Clitheroe.—Proposed Light Railway.—The Light Railway Commissioners have informed the R.D.C. that they will submit the Longridge and Hellifield light railway scheme to the B. of T., provided the cost does not exceed £6,000 per mile, instead of £10,000, as estimated by the promoters.

Dewsbury.—The local manager of the Dewsbury and Ossett tramways has informed the T.C. that his men have been called up to such an extent that, unless time is allowed to train others, certain sections of the service will have to be suspended.

Edinburgh. — Queensferry Extension. — The T.C. has decided to withdraw the Queensferry tramway scheme, which was to have been the subject of an inquiry next month.

Electric Vehicle Progress.—The following proposals are before the municipalities for the purchase of electric vehicles:—Maidstone, one 3½-ton tipping wagon, to cost £1,200; Gloucester, one lorry, £1,200; Sheffield, chassis, for use as tower wagon for the tramways department; Hull, tipping wagon, £1,165; Glasgow, two 2-ton vehicles, £1,168 each, and two 3¼-ton vehicles, £1,432 each; Burnley, electric vehicle for the electricity department. Ilford U.D.C. has purchased a 3½-ton "Orwell" vehicle from Mossay & Co., at £1,122. Manchester Electricity Committee has obtained tenders for a 3½-ton electric tipping wagon.

A Sub-Committee of the Willesden U.D.C. is considering the question of garage accommodation and facilities for charging three electric vehicles for the collection of refuse.

Glasgow.—Fuel Economy.—In a statement to the employés of the tramway department, Mr. J. Dalrymple, the general manager, said that by careful driving the undertaking could save 10,000 tons of coal per annum; this would represent about £10,000, half of which would be handed to the drivers.

London.—L.C.C.—The L.C.C. and the Metropolitan Electric Tramways have arranged for an additional through service *viâ* Stamford Hill.

At one of the power stations of the Council, coke is being extensively used, and arrangements have been made for the supply of from 100 to 1,000 tons of coke per week for 12 months.

Wages.—At a Conference, last week, between the War Cabinet and the N.U.R., an agreement was arrived at regarding the wages of railway workers. The terms of settlement include an advance of 5s. per week to men and women workers over 18 years of age, and 2s. 6d. per week to those under 18; the Government promised to expedite the Committee on the question of equal pay for male and female labour; railway shopmen are to receive the same awards as the engineering industry; and a committee representing railway managements and workers is to be set up to grant automatic advances according to the exact rises in the cost of foodstuffs. After two conferences on the award, the drivers' and firemen's organisation decided to accept it under protest, as they felt that "the offer did not cover the increased cost of living peculiar to its members." Thus the true significance of the new principle in fixing increases of wages, which has been introduced by the Government, will not be missed by wage-earners, and its recognition is not likely to be confined to railway men.

Strike.—It is stated that among the railway workers who have struck work are some of the drivers of the electric trains on the North London Railway.

Owing to the crowded nature of the tramway services in West London, due to the railway workers' strike, it is stated that only munition workers, on showing their passes, were permitted to travel in cars in the munition areas.

Underground Railway Accidents.—By the breaking of an axle near Lancaster Gate Station on the Bakerloo Railway, on Saturday afternoon, traffic was disorganised for some little time.

Due to a fire on the Hampstead and Highgate Underground Railway, trains in both directions were held up for an hour on Saturday evening.

Middlesbrough. — Tramway Purchase. — The Corporation has decided to purchase the town tramways from the Imperial Tramway Co.

Morecambe.—Electric Omnibuses.—It was stated at a meeting of the Corporation that, although the Council had last session obtained an Act of Parliament enabling it to run electric omnibuses, the Tramways Committee had not been able to induce the Ministry of Munitions to issue a priority certificate for the purchase of vehicles.

Oldham.—At a meeting of the Tramways Committee, the general manager stated that the ordinary service was not maintained owing to the absence of drivers from duty. On one day 34 men were away, and during March 1,620 car-miles were lost through this cause. The question of the substitution of women was dropped, as it was thought the gradients were too steep.

Rochdale.—Flood.—Last week the Mellor Street electricity works were flooded owing to the abnormal rise of the River Spod. The works are built on a concrete raft in a pocket of the river, and the water came through the foundations, filled the ash-pits, and ran into the boiler houses. Pumping was resorted to, but the tramway service was suspended for 2½ hours in the evening, although a restricted service was run in the morning.

Rail Remodelling. — According to the *Tramway and Railway World*, the Woods-Gilbert Rail Remodelling Co., Ltd., has been formed to acquire from the Woods-Gilbert (British) Rail Grinding and Milling Co., Ltd., its whole business of tramway rail remodelling, for which it holds the exclusive patent rights in Great Britain. The company's chief business will be to renovate *in situ* tramway rails which are considered by the owners to be worn out. The 5,329 miles of tramway track in Great Britain are, in many cases, in a defective condition, and there is a great demand for the Woods-Gilbert system of re-modelling. To meet this demand the Ministry of Munitions has granted authority for the construction of five machines, in addition to the three at present at work. The cost of these new machines will be between £2,200 and £2,500 each, and three such machines have already been put in hand, and will be ready for delivery within the next three months. These machines are already booked up on contracts which will keep them employed for fully 12 months. The system was fully described in the Electrical Review of October 13th, 1916.

TELEGRAPH AND TELEPHONE NOTES.

China.—The *Evening News* states that a contract was recently concluded between the Chinese Minister of the Navy and the German Telefunken Co. for the construction of radio-telegraphic stations throughout the Republic. The agreement has been signed with a Danish firm, which has undertaken to loan £500,000 for the purpose, covering a period of 30 years, during which the Copenhagen concern, one of whose principals at one time acted as manager for the Telefunken company in Shanghai, will control the various installations, with the assistance of Chinese officials.

Germany.—An official notice was issued early in September offering rewards for the denunciation of any unauthorised wireless transmitting or receiving stations in Germany. A search for stations is constantly being made, and in case of discovery the apparatus is seized and the owner punished. The amount of the reward is fixed in each case; it may be £5 or more.

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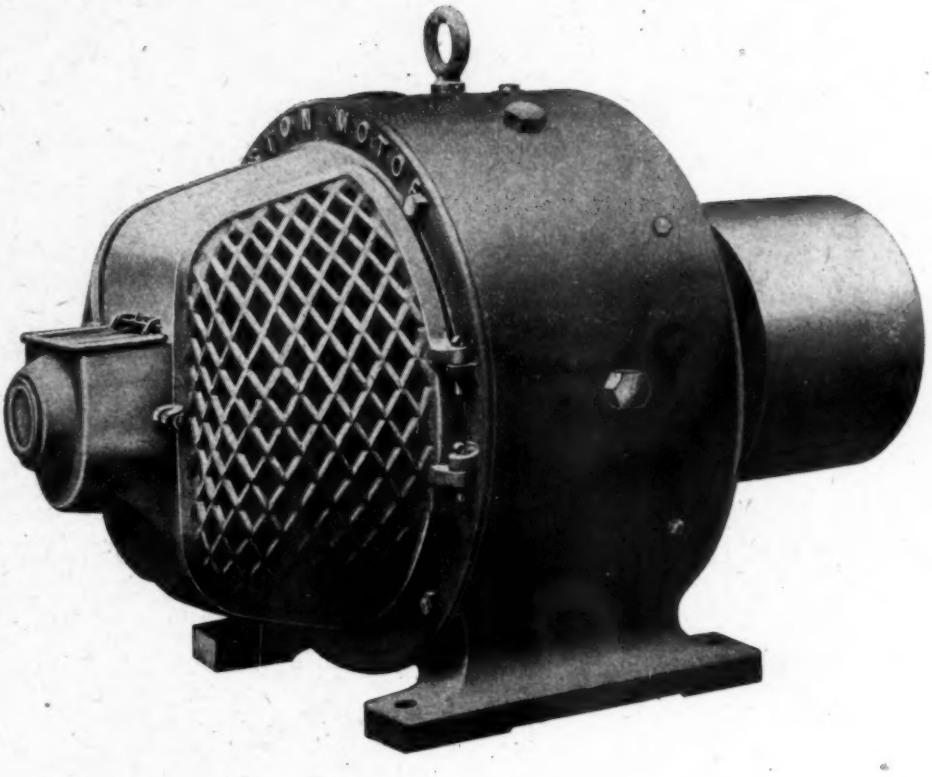

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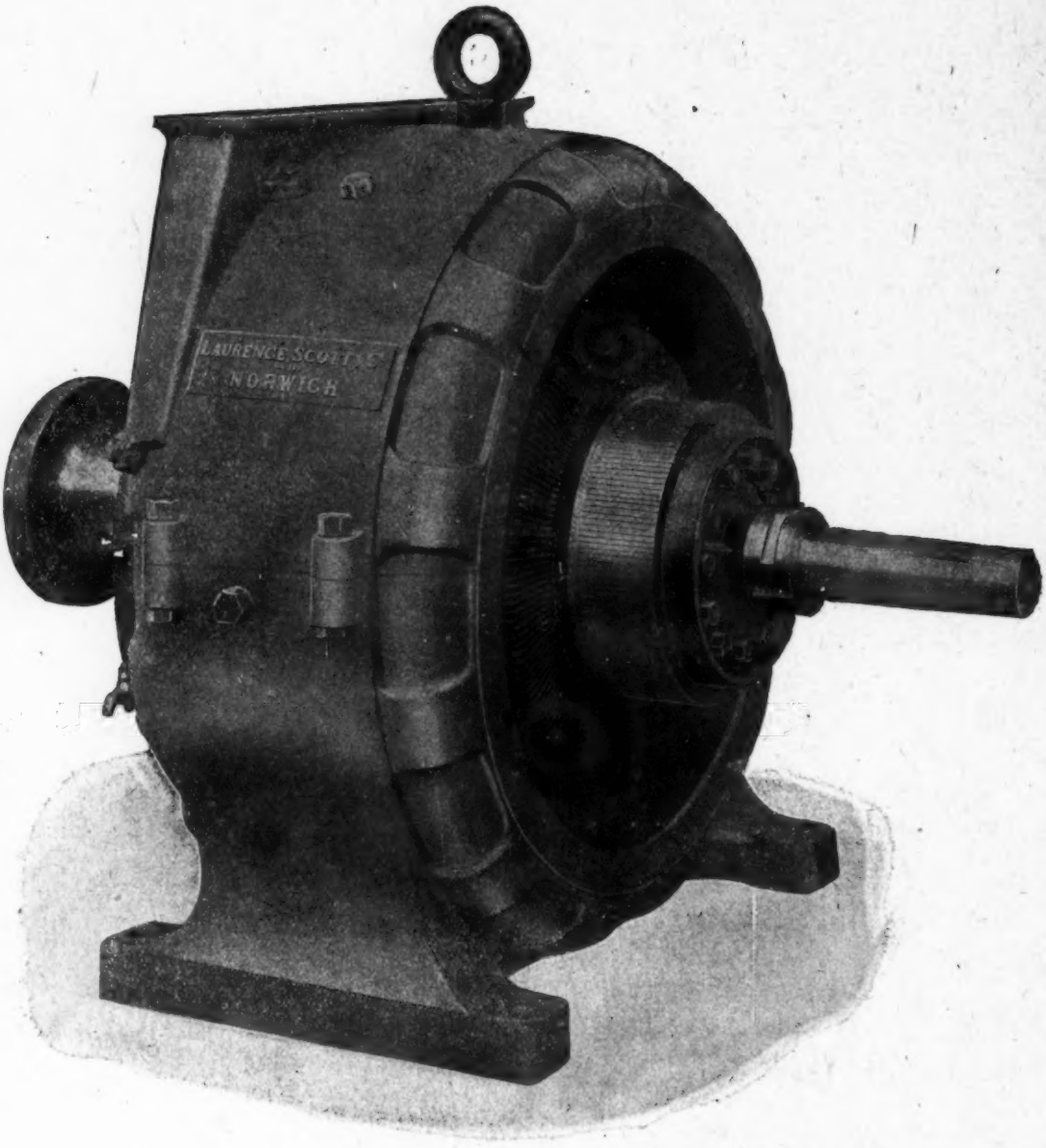
LIVERPOOL: 518, Royal Liver Buildings.

M. 119



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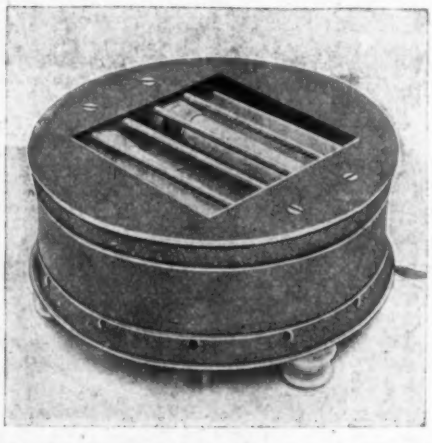

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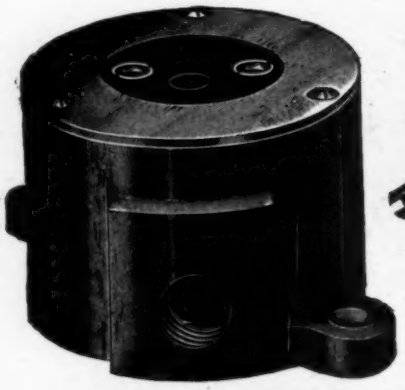

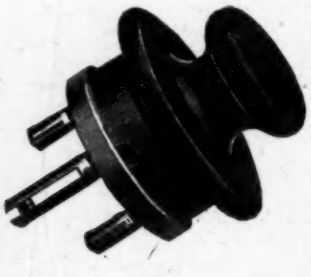

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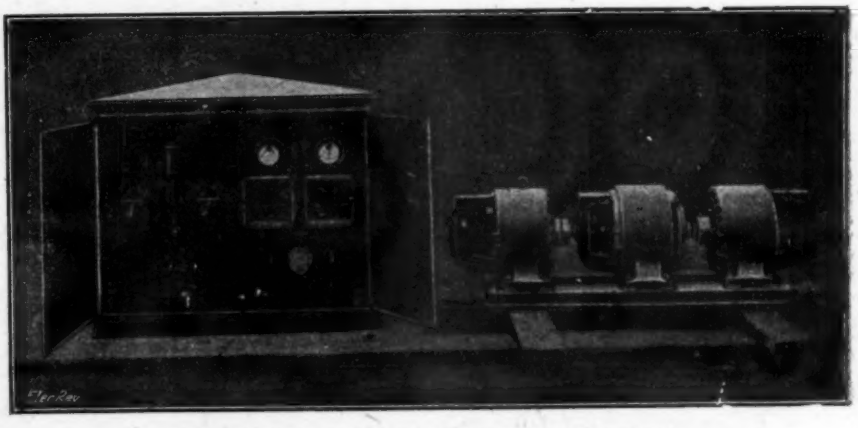

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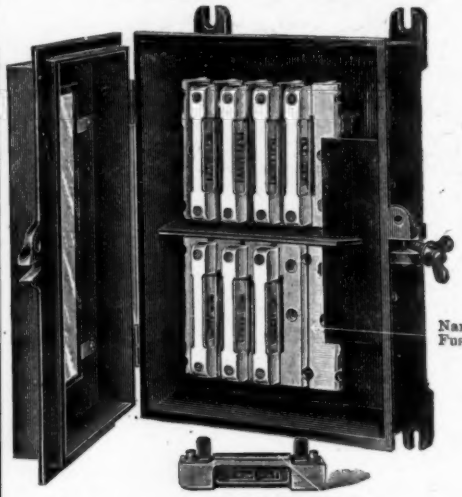

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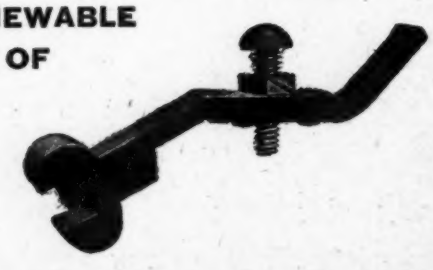

Illustration is about half size and represents Finger suitable for B.T.H. B18 Controllers.

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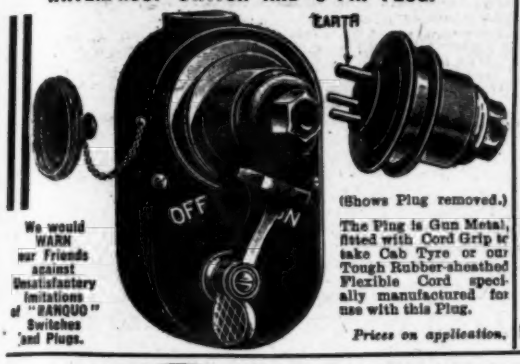

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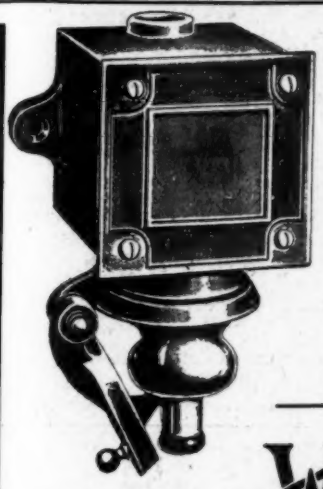

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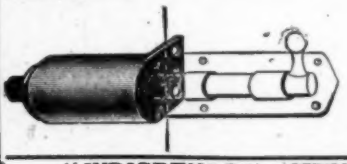

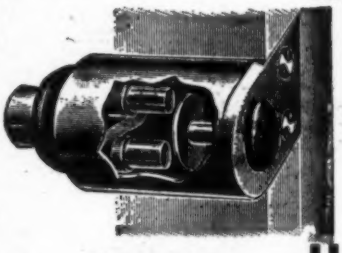

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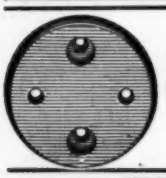

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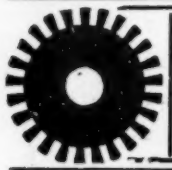

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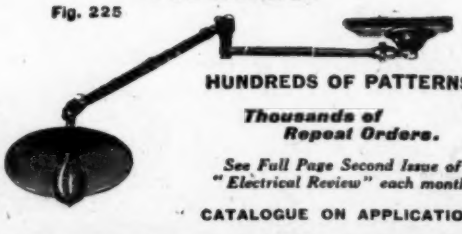
Fig. 225



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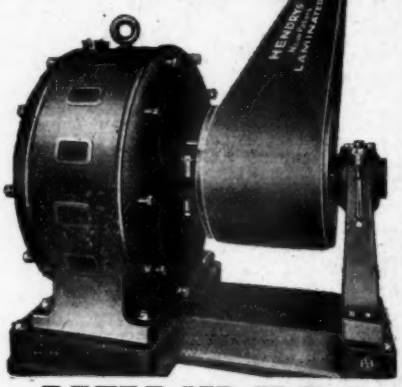

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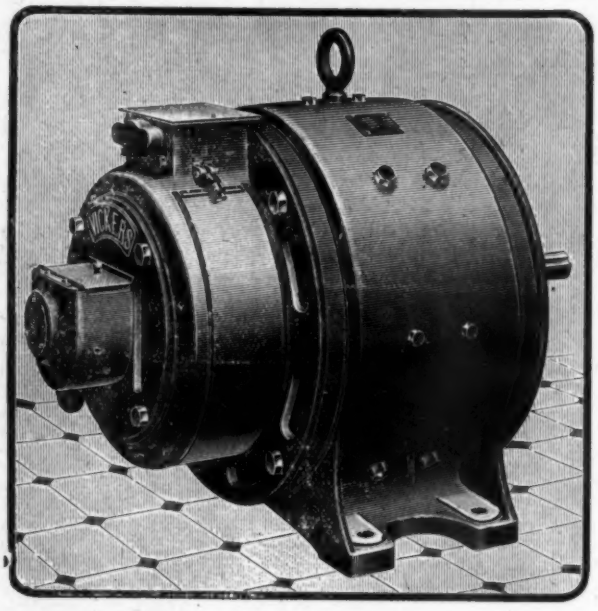

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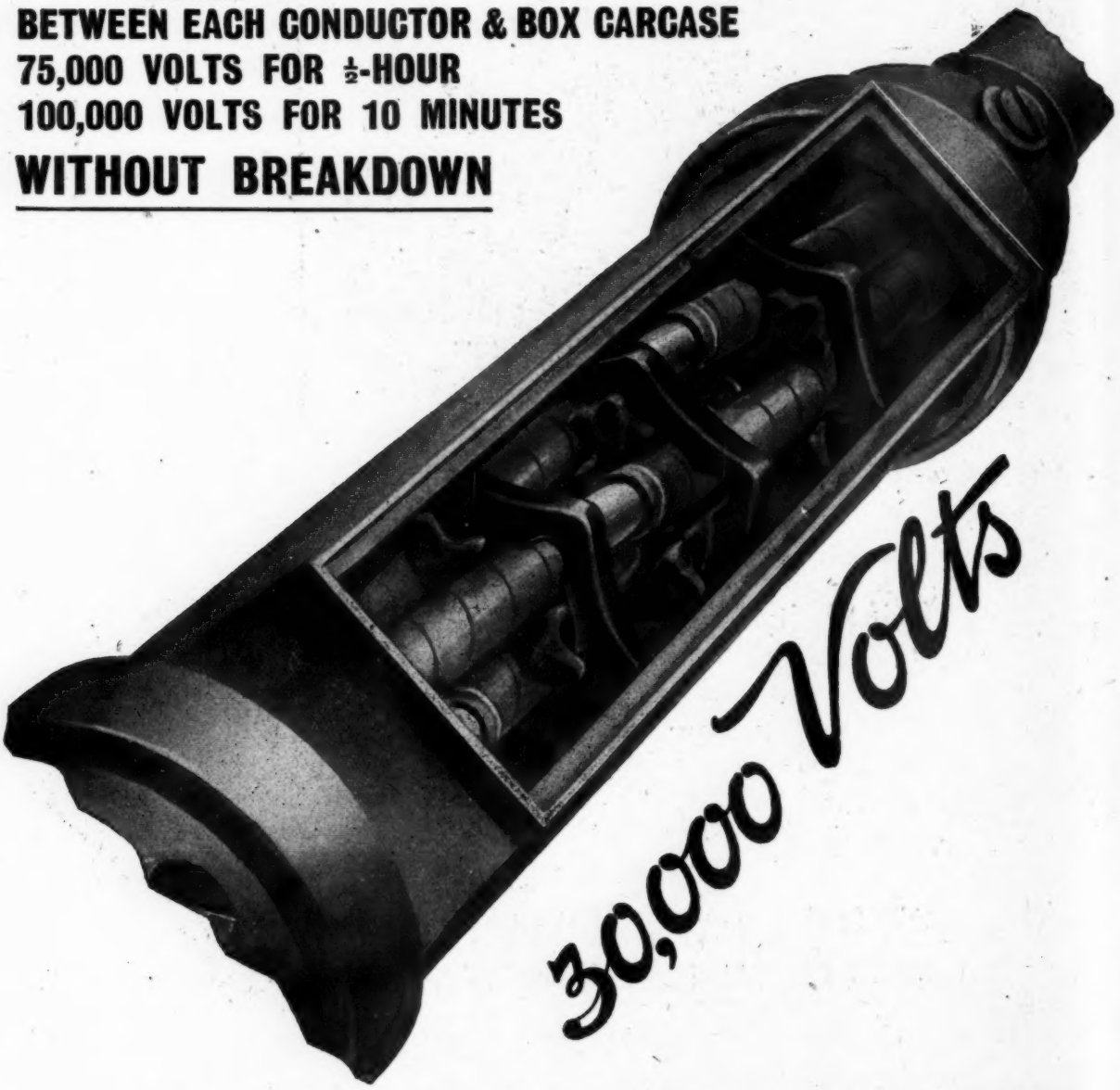

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WILL

SELL the above PROPERTIES by AUCTION,

At the "Greyhound" Hotel, Croydon, on

THURSDAY, OCTOBER 3rd, 1918,

AT 6.30 P.M.,

(Unless previously disposed of by Private Treaty).

Further Particulars of the AUCTIONEERS, 128, George Street, East Croydon, and Branches. 2680

SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

BOROUGH OF DARWEN.

THE COUNCIL invite applications for the position of Electrical Engineer and Manager of their Electrical undertaking. The person appointed will have the management of the refuse destructor. Salary £300 per annum.

Applications, endorsed "Electrical Engineer," together with three testimonials, to be forwarded to me the undersigned not later than SATURDAY, the 12th day of OCTOBER, 1918. Canvassing will disqualify a candidate.

WILLIAM P. HALLIWELL,
Town Clerk.

Town Clerk's Office, Darwen.
25*th September*, 1918. 2690

ASSISTANT AND JUNIOR ENGINEERS.

WANTED, Assistant and Junior Assistant Engineers for combined Lighting, Power and Traction Station.

Applicants should have had technical training, turbine and alternating current 3-phase experience, and be thoroughly competent to take charge of steam plant consisting of Lancashire and Tubular Boilers, Reciprocating Engine and Turbine.

Applications to be in writing, stating age, wages required and details of experience.

2685, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

WAKEFIELD CORPORATION ELECTRICITY DEPARTMENT.

CHARGE ENGINEER wanted immediately to take charge of eight-hour shift in a high-tension, A.C. power-station, plant capacity 4000 KW.; present wage £3 13s. 8d. per week, including all bonuses. Only applications from men having had experience in a similar post will be considered.

Application, giving full details of experience and age, to be sent to H. A. NEVILL, City Electrical Engineer. 2708

STOKER.

WANTED, Man to assist in boiler house, and act as Assistant Stoker. All mechanical coal handling and mechanical stokers. Only those with previous experience need apply. Wages 6½d. per hour for 58-hour week, plus £1 per week, plus 12½%. Average weekly wage 58s.

Apply at once, ELECTRICITY WORKS, Maidstone. 2716

JOINTER.

JOINTER (permanent) wanted for three-wire network; experience with V.B. and triple-concentric cables necessary. Good wages will be paid to suitable man.

Full particulars to CORPORATION ELECTRICITY WORKS, Perth, Scotland. 2717

SITUATIONS VACANT.—*Continued.*

ASSISTANT ELECTRICAL ENGINEER.

WANTED, for large controlled establishment in the North, a first-class man, must be well-up in armature winding and all D.C. and A.C. repairs. Good opening and progressive salary to the right man. No person already employed on Government work will be engaged.—Apply, stating experience, to 2628, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SUB-STATION ATTENDANT WANTED.

MUST have had experience with three-phase converters and D.C. three-wire supply, and have had control of a sub-station of not less than 1000 KW. capacity.

Apply, stating age, experience and medical grade, and enclosing copies only of recent testimonials, to ENGINEER, 27, Osborn Street, Whitechapel, E. 1, not later than TUESDAY, OCTOBER 1st, 1918. 2702

INSTRUMENT REPAIRER.

INSTRUMENT REPAIRER required for repairs to meters and electrical instruments. Good small lathe hand essential. Used to accurate work. Wages 10½d. per hour, plus bonuses.—Apply in writing, giving particulars, 50, Eden Grove, Holloway, N. 7. 2656

BURGH OF PAISLEY.

MANAGER wanted for Paisley Corporation Electricity Works. Salary £600 per annum, free house, coal, and light.

Apply, giving full details of qualifications, to the TOWN CLERK, Paisley, not later than 9th OCTOBER. 2651

CABLE JOINTER.

CABLE JOINTER wanted for Underground Three-wire Cable System; must have good experience in mains and services and locating of faults.

Apply, stating experience and wages wanted, to BURGH ELECTRICAL ENGINEER, Corporation Electricity Works, Alloa. 2679

SHIFT ENGINEER.

SHIFT ENGINEER wanted for A.C. and D.C. station (certified undertaking); must have had experience with Turbines and E.H.T. 3-phase Plant. Wages £3 5s. (plus 12½ per cent.) per week.

Apply, giving full particulars, to the BOROUGH ELECTRICAL ENGINEER, Corporation Electricity Works, Leigh, Lancs. 2695

FITTER.

FITTER required in central station. Previous knowledge desirable of turbines and other central station plant. Wages 10½d. per hour, plus bonuses.—Apply, 50, Eden Grove, Holloway, N. 7. 2655

DRAUGHTSMAN.

REQUIRED, Draughtsman in central station. Mechanical training desirable. Wages £2 15s., plus bonus.—Apply in writing, giving particulars, 50, Eden Grove, Holloway, N. 7. 2654

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

AN electrical and mechanical engineering firm of good standing, Westminster, requires an Assistant to act directly under the principal. No person resident more than 10 miles away, or already on Government work, will be engaged.—Applications, with full particulars of age and experience, to Mr. W. G. WALKER, A.M.C.E., M.I.M.E., Emery Hill Street, Westminster, S.W. 1. 2696

ARMATURE Winder. Repair work in tramway depôt. State experience and wages. Permanent job for right man.—SOUTH METROPOLITAN TRAMWAYS, 30, High Street, Sutton. 5577

ARMATURE Winder wanted for repair work in East London. No one residing more than 10 miles distant, or at present on Government work, need apply.—5549, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winder wanted; preference given to man with traction experience. Full district rate and all awards paid; constant employment, Glasgow district.—Reply, stating experience, to 2643, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANT Foreman Platelayer wanted; first-class man with experience of repairs and renewals of tramway permanent way. Wage £4 per week and overtime.—Apply, stating age and experience, with copies of testimonials, to GENERAL MANAGER, Corporation Tramways, Coventry. 2616

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

ASSISTANT to Manager wanted for electrical engineers' buying and stores department. Experience in up-to-date methods of providing and keeping records of material for work in hand essential. No person already employed on Government work will be engaged.—Apply, stating age, experience, and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2652.

CAPABLE Man required for testing and repairing of A.C. and D.C. meters.—Apply, with full particulars and wages required, to GENERAL MANAGER, Power Station, Downing Street, Smethwick. 2693

CHARGE Engineer for alternating current supply, Certified Undertaking. Applicant must have had experience in modern turbine station, and be used to keeping supply station records. Permanent job. Commencing salary £3 10s. per week.—Apply stating experience, 2684, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer wanted for combined A.C. and D.C. station near Glasgow; also Switchboard Attendant.—Apply, giving full particulars of experience, age and wage expected, to 2635, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineers wanted for power house of 800 H.P., to run seven 8-hour shifts. Experience with gas and steam engines, and batteries desired. Must be ineligible for military service.—State age, wages required, with two references, to CHIEF ENGINEER, Blackpool Tower Co., Blackpool. 2694

CHIEF Tester required, to take charge of transformer test, by large electrical firm in the Midlands. Permanency to suitable man. No person already on Government work will be engaged.—Apply, stating age, experience, salary required, and quoting No. A6003, to your nearest EMPLOYMENT EXCHANGE. 2534

DRAUGHTSMAN required for Electrical Instrument Experimental Government work. (South of England). Nobody on Government work, or residing at a greater distance than 10 miles, need apply.—Write, stating age, experience and wages required, to 2707, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, several good mechanical, wanted for design of steam turbines, electrical machines, and control gear, by large firm in the Midlands. No person already on Government work will be engaged.—Apply, stating qualifications, age, salary required, and earliest date can commence, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper, and No. A5996. 2529

DRAUGHTSMAN, with experience in small electrical switchgear, distribution boards, and electrical accessories generally. Progressive position for the right man. Commencing salary £3 10s. per week. No one employed on Government work, or resident more than 10 miles away, need apply.—Write, stating age and experience, to THE SUN ELECTRICAL CO., LTD., 57/59, Neal Street, Long Acre, W.C. 2617

DRAUGHTSMEN for transformer work, required by large electrical firm in the Midlands. Previous experience not essential. Permanency to suitable men. No person on Government work will be engaged.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, quoting No. A6005. 2533

DRAUGHTSMEN, senior and junior (Tyneside), for switchgear. No person already employed on Government work will be engaged.—Apply by letter, stating age, salary, and experience, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2666.

ELECTRICAL Engineer wanted. No person resident moreth an 10 miles away, or already on Government work, will be engaged.—Address, stating age and salary required, also experience in management of Diesel, gas, and tar-oil engines, to "ENERGY," c/o J. W. Vickers & Co., Ltd., 5, Nicholas Lane, E.C. 4. 5600

ELECTRICAL Fitters and Wiremen, skilled men only; full rate. No one employed on Government work, or living more than 10 miles away, need apply.—W. M. WILLIAMSON, Electrical Engineer, 104, Peckham Rye, S.E. 5607

ELECTRICAL Manager wanted by Contracting Firm in Lancashire. Will be required to take full charge of department. Applicants must be fully experienced in lighting and power installations, handling of men, preparing estimates, and carrying out of work. No person on Government work will be engaged.—Write, with full particulars as to experience and salary required, to Box G837, LEE & NIGHTINGALE, Liverpool. 5637

ELECTRICAL Wireman wanted to take charge of plants, wiring and general installations for circuit of provincial theatres. Comfortable permanent job to good man.—Apply, in first instance, stating full particulars, to 2659, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN required for Estate Installation, consisting of gas engines, gas producer plant, electrically-driven pumps and sawmill, lighting, telephones and bells. Good wages to a suitable man; preference given to a discharged Army man.—2642, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN wanted for C.A.V. 'bus lighting on a fleet of motor 'buses in the provinces; 60 hours, 1s. 3d. per hour.—2569, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

ELECTRICIANS wanted at large Controlled Works, must be well up in D.C. motor repairs and armature winding. No person at present on Government work need apply.—Apply, stating age, wage and experience, to 2633, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINE Driver required for Diesel station (Certified Undertaking). — Apply, stating wages expected, to MANAGER, Electricity Works, Staines. 2712

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER required, accustomed to the repair, overhaul and running of Belliss engines and generating station plant generally. Wages 42s. per week of 54 hours, 25s. weekly war bonus.—Apply, giving full particulars, experience, age, &c., to I. BULFIN, General Manager, Corporation Tramways, Bournemouth. 5627

FOREMAN and Storekeeper wanted by electrical engineers, one accustomed to the manufacture of heating and cooking appliances; discharged soldier considered. No person resident 10 miles away, or already on Government work, need apply.—2687, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OVERHEAD Linesman, tramways; 56-hour week, wages 56s. per week, plus 12½ per cent. war bonus.—Apply, with references, stating age and experience, to 5596, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PAVIOR or Working Permanent Way Foreman required for tramway track, regular work.—Apply, stating age, experience, present position, references and wages required, to BURTON AND ASHBY LIGHT RAILWAY, Swadlincote, near Burton-on-Trent. 5559

PUBLICATION Assistant wanted for compiling technical data and engineering catalogues. Either a well-educated young lady or an ineligible man, preferably with some engineering knowledge. Must possess good knowledge of English and some initiative. No person already employed on Government work will be engaged.—Apply, stating age, previous experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. A6024. 2590

REPRESENTATIVE required for country districts with connections and experience. Suitable terms to a good man. No person resident more than 10 miles away, or already on Government work, will be engaged.—5567, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer Junior wanted, A.C. and D.C., Midland power station. Pay £3 weekly, including all war bonuses to date.—Apply with full particulars to 2667, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer required at large London Power Station (certified by Government) on running of mechanical side of plant. Must be skilled mechanic with experience of large turbine units. Inclusive wage from £4 10s. to £5 per week.—Reply, stating age and particulars of experience, to 5623, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer required for hydro-electric power station in North Wales. Suitable post for discharged soldier with electrical experience.—Apply with references, stating wages required, to 2600, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer wanted for controlled establishment; must have good electrical and mechanical experience. Good wages according to qualifications. No person already on Government work will be engaged. — Applications, stating age, experience, when at liberty, &c., with copies of recent testimonials, to be addressed to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6106. 2721

SHIFT Engineer wanted for Hydraulic Power Station in North Wales. Must be experienced in large D.C. Generators, A.C. and Transformer Plant. No person already employed on Government work will be engaged.—Apply, stating salary expected, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5902. 2676

SHIFT Engineer wanted for power station.—Apply, stating age and experience, to LANARKSHIRE TRAMWAYS CO., Motherwell. 2520

SHIFT Engineer wanted, 3-wire, D.C., station with battery. Certified Undertaking. Babcock & Wilcox boilers and turbine experience preferred.—Apply, stating qualifications, age, medical category and wages required, to MANAGING ENGINEER, Banbury and District Electric Supply Co., Ltd., Banbury. 2720

STOREKEEPER wanted. No person resident more than 10 miles away, or already on Government work, will be engaged.—Reply, stating age, experience and wages required, J. H. TUCKER AND CO., 217, Shaftesbury Avenue, W.C. 2. 5612

SUPPLY Undertaking (certified occupation) at seaside town in West has vacancy for outside Working Foreman to do wiring work and keep motors and meters in repair; able to do occasional jointing on cables. Permanency for suitable man. Wages (including bonus) £3.—State age, experience and medical category, to 2657, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

SWITCHBOARD and Sub-station Attendant wanted for A.C. and D.C. station in West of England (Government Establishment). Good wages plus war bonus per week of seven 8-hour shifts, plus 12½%. Sunday, time and half. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, giving full particulars of training and experience, and stating military category, and mentioning No. A6013. 2531

SWITCHBOARD Attendant, able to do wiring if necessary. Discharged soldier or junior. State experience and wages. North-east coast.—5622, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TECHNICAL Assistant wanted by motor control gear manufacturers in London District. Must be conversant with the details of design and manufacture of all classes of motor control gear. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, experience and wages required, to 5569, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TEST-Room Assistants wanted conversant with motor control gear. No person on Government work or living more than 10 miles away engaged.—Apply, stating age, experience and wages required, to THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W. 8. 5500

TESTERS for transformer work required by large electrical firm in the Midlands. Permanency to suitable men. No person on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, stating age, experience, salary required, and quoting No. A6002. 2535

THOROUGHLY competent Elect.ician-Wireman required at once for Provinces, to take charge of several installations, including wiring, &c. Comfortable permanency to right man.—Apply ALBANY WARD, Guildhall Chambers, Weymouth. 2660

WANTED, Assistant Manager for electrical contractors' business, engaged in power motor supply, erection and maintenance, armature re-winding and small repairs. No person resident more than 10 miles away, or already on Government work, will be engaged.—2626, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED at Once, a Competent Man to re-wind armatures, and do general repairs for a D.C. plant at a colliery in North Wales.—State wages, and give full particulars of experience, to 2669, ELECRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by leading engineering insurance company, Electrical Surveyors, having good knowledge of the theory and practice of alternating and direct current plant. Applicants must be ineligible for the Army or Navy.—2581, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Competent Working Electrician, to take charge of a country house plant at Maidenhead (gas engine, 500 lights), and do general repairs on the estate.—Apply in writing, stating qualifications and wages required, to H. J. WAGG, 34, Dover Street, W. 1. 2705

WANTED, Constructional Engineer, experienced in the design and lay-out of generating stations. Permanency.—Apply, stating full particulars, together with copies of testimonials and salary required, to 2630, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Costs Clerk, chiefly electrical work, preferably one who has had experience in store-keeping. Good prospects to suitable man.—Apply, stating full particulars of past experience, together with copies of testimonials and salary required, to 2631, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Electricians, used to screwed conduit work, cleat wiring, power, telephones, &c. Permanency. Good wages. No person already employed on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning number A6070. 2672

WANTED, first-class Armature Winders. No man on Government work, or resident more than 10 miles away, need apply.—MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 1. 2625

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED, good Electrician to take charge of about 30 motors in controlled works. Must be capable of any repairs and re-winding if possible. No person resident more than 10 miles away, or already on Government work, will be engaged. State wages, age, &c.—5610, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, smart youths with some electrical experience; good prospects. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply 187, Hercules Road, Lambeth, S.E. 2711

SITUATIONS VACANT.—*Continued.*

WANTED, Wiremen for electrical light and motor installations, screwed barrel. No person already employed on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A6046. 5591

WANTED, working Electrician, to take charge of electric plant.—Apply, with full particulars, to C. TOWNSEND HOOK & CO., LTD., Paper Makers, Snodland, Kent. 2704

WIREMAN for urgent Government work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply NAPIER-KIMBER, 3, Wellington Terrace, Bayswater Road, W. 2686

WIREMAN wanted. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply F. G. EDEY & CO., LTD., 25, Warwick Lane, London, E.C. 4. 5624

YOUTHS wanted to gain experience in switchboard work. No person resident more than 10 miles away, or already on Government work, will be engaged.—CECIL HODGES, LTD., 105, Dalston Lane, London. 5516

SITUATIONS WANTED.

A COMMERCIAL Engineer, of first-class practical engineering and manufacturing experience, with sound technical knowledge, contemplates change; capable organiser, energetic and tactful in control of staff; considerable experience in negotiation of trading agreements.—5583, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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ADVERTISER requires position as Switchboard Attendant on H.T. plant. Six years' experience on L.T. work. Technical and mechanical training. Discharged from the Army. London district.—5561, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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AN Engineer, with 25 years' experience in mechanical and electrical engineering, accustomed to large plant and to the management of men, seeks position as Manager or Outside Representative.—5616, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AS Wireman's Mate, discharged soldier; conduit erecting, maintainance and test-room experience. London preferred. State wages offered.—5630, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Engineer desires an appointment; over 12 years' experience in the generation and distribution of electrical energy.—5311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONTRACTORS' Electrical Engineer, eight years' experience in low-tension and extra-high-tension cable laying and overhead line contracts; well up in power installation work in mills, and lighting distributions for camps; can handle large gangs of men, and get contracts through against time.—5537, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, A.M.I.E.E. (27), Grade 2, seeks appointment; design of electrical apparatus, 6 years' radio experience, testing and experimental work, technical experience in large manufacturing concern; good references.—5555, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer seeks charge of small undertaking; power station preferred; home or abroad.—"ENGINEER," 27, Chetwode Road, Balham, S.W. 17. 5531

ELECTRICAL Engineer (33), A.M.I.C.E., A.M.I.E.E., with college training and experience in instrument and research work, desires permanent responsible post.—5634, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN Assistant seeks light situation, age 16½, good experience.—S. ISAAC, 106, Chrisp Street, Poplar. 5621

ELECTRICIAN Assistant seeks light situation; age 17½. Ineligible; good experience.—E. I., 106, Crisp Street, Poplar. 5513

ELECTRICIAN, discharged, thoroughly experienced in factory, construction, maintenance, power, lighting, and general plant; take full responsibility; good testimonials.—5594, ELECTRICAL REVIEW, 4, Ludgate Hill, London

ELECTRICIAN (discharged) wants maintenance job; experienced D.C., 3-wire, batteries, rotaries and wiring.—G. H. HAYWARD, 15, Pakenham Street, Mount Pleasant, W.C. 1. 5584

ELECTRICIAN (exempt), desires change, motors, lifts, lights, &c., factory work.—G. S., 46, Mayton Street, N. 7. 5604

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

ELECTRICIAN (24), seeks responsible position; skilled, practical technical and business experience; army rejection final.—"ELECTRICIAN," 3, Malcolm Road, Woodside, S.E. 25. 5632

ENGINEER, M.I.E.E., M.I.M.E, manager of electricity supply undertaking, desires responsible position in engineering concern. Thoroughly acquainted with steam, Diesel and gas engine plant and A.C. and D.C. supply. Works training, commercial and installation experience.—2713, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER-Electrician, charge hand, 22 years' all-round experience: low category.—5620, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN-Electrician (33), competent all-round mechanic.—37, Argyle Street, Leytonstone, E.11. 5625

INSTRUMENTS.—Administrative position wanted. 16 years' practical electrical instrument experience. Salary £400 to commence.—5628, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LADY Clerk, with several years' electricity works experience, seeks position, shorthand, typewriting, consumers' accounts, &c. Good testimonials.—2714, ELECTRICAL REVIEW, 4, Ludgate, Hill, London.

RE-ENGAGEMENT with an Electrical Supply Undertaking required (to manage branch office), by a young man, military unfit, with London experience.—5631, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT-Engineer requires change for experience; A.C. station; thorough mechanical training, B. & W.; near London preferred.—5614, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SOUTH Wales preferred.—Electrical and Mechanical Engineer, having previous experience there, desires change. 17 years' experience. Estimating, erecting and supervising A.C. and D.C. power, and lighting all kinds of engineering industries. Technical with real practical abilities. Organiser, accustomed to control men. Present sales and installation engineer, municipal supply authority.—5518, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS Electrical Engineer (aged 29), discharged service, strict disciplinarian, would be glad to hear of a situation, home or abroad, where initiative and organising ability would be appreciated. Salary £6 10s. during war.—5533, ELECTRICAL REVIEW, 4, Ludgate Hill, London

YOUNG Shift Engineer requires progressive position in central station; experience in D.C. and A.C., turbine and reciprocating, B. & W. accessories; apprenticeship; near London preferred. —5613, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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GENTLEMAN travelling Yorkshire and Lancashire, with good central showrooms, stores and offices, desires Agencies, electrical accessories, apparatus or machinery.—5590, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LOCAL Agents wanted in every town to collect old Electric Lamps on Commission.—Write, 104, Craven Park, London, N.W. 10. 4932

FOR SALE.

MACHINERY FOR SALE.

FOR SALE, 5, 15, 25, 30 H.P., 440 V., D.C.; 3, 7, 10, 12, 15, 20, 25, 27 H.P., 440 V., A.C., two and three-phase, 50 periods. Switches, Fuses, Starting Gear, automatic features and non-automatic; Cable from 1/18 to 37/12; Ironclad Fuse Distribution Boards, with and without circuit switches, Home Office pattern; Power Circuit Breakers, two and three-phase, from 100—600 amps.

Materials and workmanship, the Best. Technical advice given with quotations if required.

Your enquiries and deliveries, prompt attention.

Apply—

ROBUST MACHINERY,
62, Bradford Street, Walsall. 2603

MACHINERY FOR SALE.

One 50-KW. Browett-Silvertown Generating Set, 500 volts, D.C.
One 70-KW. Willans & Robinson-Mather & Platt Generating Set, 500 volts, D.C.
One 150-KW. Belliss, triple-expansion, Bruce Peebles Generating Set, 500 volts, D.C.
One 150-KW. Belliss compound Silvertown Generating Set, 220 volts, D.C.
Two 180-KW. Scott & Mountain Generating Sets, 210 volts, D.C.
One 150-KW. Belliss-Mavor & Coulson Generating Set, 220 volts, D.C.

ROBERT WALKER,
2, Oswald Street, Glasgow. 2607

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

NEARLY new, No. 2 size powerful Motor-Driven Portable Facing Machine, by Hetherington & Co., for roller paths of large gun turrets, swing bridges, &c.
"Victor" Full Automatic Turret Lathe, by Smith and Coventry, with 2¾" spindle.
50-KW. Steam Generating Set, by Scott & Mountain, direct coupled to Generator, 500 volts, 100 amps., 500 revs.
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(Continued on next page.)

FOR SALE.—*Continued.*

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One 300-KW. Belliss-E.C.C., 460/500 volts.
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One Crompton, 150-H.P., 25-period, 3-phase, slip-ring.
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Two 200—220-volt 1500 watts.
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BROWETT, LINDLEY Totally Enclosed Vertical Engine; 19-in. and 36-in. cylinders, by 18-in. stroke. Metallic packings, piston valves, drum governors, fly-wheel and barring gear.

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Seen as left off work.

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FOR SALE.—*Continued.*

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3-PHASE, 50 CYCLES; 440 VOLTS.

250, 70, 60, 57, 50, 37, 30, 25, 10 H.P., slip-ring.
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400/460 VOLTS, D.C.

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100/110 VOLTS, D.C.

5 H.P. and 70 amperes at 60 volts.

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200-KW., 460-volt, direct-coupled Steam Set.
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Two 50-H.P., 230/325-volt, "Stockport E.C.C.," complete.

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24 12" cut glass dish fittings, with nine outside lights and taree chains, suspension.
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39 lights, „ „ „
And others.

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"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m.; built in 1910, and in first-class order.

Specification and print on request.

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One 2-H.P., 440-volt, 1700 R.P.M., complete with pulley.
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(*Continued on next page.*)

FOR SALE.—*Continued.*

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FOR SALE.—*Continued.*

CROSSLEY 6-H.P. Gas Engine, all complete. Newton Dynamo, 220 volts, 15 amps., and Switchboard fitted with volt and ammeter meters. Two split Iron Pulleys, 40″ and 32″ diameter; four split Wood Pulleys, 8″, 21″, 25″, and 26″ diameter. Sell separate or together.—MOTOR CO., Hereford. 5598

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FOR Sale, about 1000 yards new Cab Tyre Trailing Cable, 3-core, 110/24. S.W.G. and earth wire.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2697

FOR Sale, Balancer consisting of two 28-KW., 230-volt machines, coupled together. Price, £200.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2611

FOR Sale, Electric Hoist, by Manlove, Alliott. Two winding drums, driven by 100-volt D.C. motor.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 2649

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FOR Sale, Motor, 2 H.P., D.C., by G.E.C., with starter, slide rails, in first-class condition. £20.—PARSONS & HODGES, LTD., 63, Parade, Leamington. 5618

FOR Sale, New Expanded Metal Transformer Cage, 10 ft. × 7 ft. × 5 ft., with doors at end; £20.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2544

FOR Sale, new Westinghouse 3-phase Switch Cubical for 200-H.P., 440-volt Motor or Generator.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2543

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FOR Sale, two 24″, 110-volt, D.C. Ventilating Fans. Price £15 each.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2701

FOR Sale, vertical, high-pressure, three-throw Pumps, plungers 7½″ × 9″ stroke, driven by steam engine.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 2650

(Continued on next page.)

FOR SALE.—*Continued.*

FOR Sale, 13-H.P., 220-volt, 950 R.P.M., enclosed ventilated shunt-wound Motor with starter. £55. — THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2613

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FOR Sale, 300-KW., 110-volt, 50-period, 300 R.P.M., single-phase Alternator, by Crompton, with direct-coupled exciter.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2700

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STOCKS of Cable, Bell and Lighting Accessories, Lamps, &c., purchased for cash. Large and small quantities.

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A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowcap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 5392

A1 CASH Prices given for Electric Cable, Flexible Wire, Electrical Accessories, &c.—Apply DAVIS, 11, Sun Street, E.C. 2. 1424

ARTICLES WANTED.—*Continued.*

CABLE.—The Guildford Electricity Supply Co., Ltd., of Onslow Street, Guildford, require from 5 to 10 yards of lead-covered T.C.C Cable, the outer conductor '25, the two inners '50. 2689

DYNAMO, 1—2 or 3 KW., with shunt regulator, 50—70 volts, wanted; also 25 cells, about 250 amp.-hour.—F. GOWER, West Street, Bognor. 5599

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GENERATING Set wanted, 100 KW. or near, 110 volts, 150 lbs. steam pressure. — 2563, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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HORIZONTAL Oil Engine required, capable of developing continuously 10 B.H.P. Complete with all usual accessories, and preferably of special electric lighting type, and of Hornsby or other first-class make; new, or second-hand in first-class condition. Urgent.—JOHN HUNTER & Co., 11, Paradise Street, Liverpool. 2691

MEGGER wanted, Evershed preferred, 1000 volts or 500 volts, constant pressure. Must be in good condition.—Send full particulars and prices to W. CANNING & Co., Salop Street, Birmingham. 2668

MOTORS Wanted (new or second-hand).—Two 60-H.P., A.C., 3-phase, 50-cycle, induction Motors, speed about 480/580 R.P.M., with oil-immersed circuit breaker and ammeter and oil starter; complete with brush lifting and short circuiting device. One 50-H.P. Motor as above, complete. One 5-H.P. shunt-wound Motor, D.C., 230 volts, with back gearing reduced on counter shaft to about 150 R.P.M., with starting panel to suit, hyde pinion on motor. One 5-H.P. induction, A.C., Motor, 440 volts, 50 cycles, 3-phase, with back gearing, speed on counter shaft about 150 R.P.M., hyde pinion on motor. One 5-H.P. shunt-wound Motor, fitted with interpoles, 740 R.P.M. normally on 230 volts, to run up to 1,035 R.P.M. maximum by shunt regulation, and down to 515 R.P.M. minimum by series regulation, with back reducing gear ratio 740/150 R.P.M. normally, complete with starting panel to suit. Lowest prices to 2665, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

NEW or Second-hand Tubing and Fittings wanted.—WALLACE, 58, High Street, Bloomsbury. 2307

OLD Cable urgently required, also Lamp Tops. — WALLACE, Cromwell House, High Holborn. 4114

OLD Electric Lamps that have had wire-drawn tungsten filaments in them with glass parts intact, 1½d. each, any make.—104, Craven Park, London, N.W. 10. 5049

OLD Electric Lamps that have had wire-drawn tungsten filaments in them previously wanted, glass parts intact. Agent's price 2d. each.—847, Harrow Road, London, N.W. 10. 4932

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road, London.

PLATINUM Scrap purchased in large or small quantities. Highest market value given.—Before selling elsewhere call or post to the old and reliable firm, THE DEPÔT, 156, Charing Cross Road, London. Established 1850. 5511

STEEL Tubes, all sorts, wanted; Lampholders and Metal and Cardboard Shades; Gas Lighters, Static Electric; Screws, round head, and Hexagon Nuts.—DUGDILLS, Failsworth, Manchester. 5052

SURPLUS Stocks Electric Cable, Plant, &c., bought for cash; also scrap cable, dynamos, motors, cells, scrap metals, lamp ends, &c.—LAKE, 132, Upper Thames Street, London, E.C. 5473

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, a quantity of B.C. Carbon Lamps, 110 volts, 5 or 2½ C.P., small bulb.—AUSTIN WALTERS & SON, Little Peter Street, Manchester. 2709

WANTED, a 1 or 1½-H.P., 230 or 460-volt Motor; also a 3-H.P. ditto, both for D.C., and a Testing Set, Paul's Bridge type, for use with 230 volts, D.C. or ohmmeter and generator, or megger type.—Full particulars, and lowest cash price, to CARK ELECTRIC SUPPLY CO., Cark-in-Cartmel, Lancs. 5602

WANTED, a 140-KW., 100-volt, shunt-wound Generator.—THE D.P. BATTERY CO., LTD., Bakewell, Derbyshire. 2584

WANTED at once, 5-H.P., 400-volt, D.C. Motor and Starting-switch; also 40 yards 7/18 Twin-armoured Cable, and 75-volt, 16-amp. Dynamo.—HORSWILL, Guilden Sutton, Chester. 5635

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

WANTED, Battery, new or second hand, 50 volts, 100 or 200 ampere-hour capacity; also Charging Dynamo for same.—5570, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Diesel, or semi-Diesel, Generating Set of 200-KW. capacity, 220 volts, D.C., preferably with converter to run on tar fuel.—PORTHOLME AIRCRAFT CO., LTD., St. John Street, Huntingdon. 2682

WANTED, Direct-Coupled Steam Set, any output from 50/100 KW., will be considered; 440/480 volts, D.C.—State full details, price and where seen, to 2311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Electric Cooking and Heating Apparatus, Kettles, Irons, Vacuum Cleaners, all voltages. Also Electric Bells, Lamps and Arc Lamp Carbons, and all classes of Accessories and Flexibles. — Fullest particulars to 2316, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Electric Turbo-Pump, 400 volts, D.C., duty 6000 gallons per hour against total lead 100 feet. — 5593, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED for cash, immediately, 7, 8 or 9-H.P., 400-volt, D.C., compound Motor and Starter. Revolutions immaterial. — Write particulars to CLARK, 123, High Street, Southampton. 5633

WANTED immediately, 210-volt, 93-cycle, single-phase Motor, about 6 H.P.; must be in good working order and have low starting torque.—ROUCH & PENNY, 17, Prince Street, Bristol. 2706

WANTED, modern Generating Set, about 200 KW., 550 volts, 3-phase, 50 periods, with Belliss or Browett engine preferred.—2562, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Motor-Generator of approximately following capacities: D.C. Generator, output 130 amps. at 80—100 volts; Motor, 200 volts, single-phase, 50 periodicity.—Offers, with full particulars, to 2710, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Motor-Generator, output 3/5 KW., for 100/150 volts, D.C. Price must accompany offer.—2434, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Motor-Generator, 400 volts, one-phase, or 200 volts, two-phase, to about 70 volts, 80 amps.; also one 440 volts, D.C., ditto.—R. F. WINDER, Cross Belgrave Street, Leeds. 2360

WANTED, one 220-volt, compound-wound Generator, suitable for belt driving, 12—25-KW. capacity.—Reply, giving full particulars, to WHIPP & BOURNE, LTD., Castleton, near Manchester. 2662

WANTED, second-hand, 440-volt D.C. Motors, 50, 10, 6 and 4-B.H.P. Price and full particulars, to E. DEWHURST, Mount Street Works, Preston. 2677

WANTED, Set of House Lighting Batteries (about 54 cells). Condition immaterial. Willing to pay good price.—C. F., 23, Britannia Street, London, N. 1. 2715

WANTED, single-phase, 100-cyle Motor, 4 H.P., 100 or 200 volts, 1,400/1,800 R.P.M.—State make, condition and price, to BOROUGH ELECTRICAL ENGINEER, Municipal Offices, Cheltenham. 5597

WANTED, small Steam Engine and Boiler, suitable for running circular saw and dynamo.—MORRISON, Birley Street, Blackpool. 2670

WANTED, two 500-KW. Generating Sets, Compound Engines, Belliss, Browett or Allens, coupled to Generators, 220 volts, D.C.—2608, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, ½-H.P. D.C. Motor, 500 volts, at once.—Send full particulars and lowest price to SIMON, 21, Panton Street, Haymarket, S.W. 2658

WANTED, 25 or 50-volt Dynamo, 1 or 2 KW., also Switchboard and complete Battery. 210-volt, 83-period, single-phase Motors, 1, 2 and 3 H.P.—W. M. WILLIAMSON, 104, Peckham Rye, S.E. 5608

WANTED, 25 to 40-H.P., 500-volt, Shunt-wound Motor.—EDMUNDSONS, 11, Tothill Street, Westminster. 2663

WANTED, 100-volt Motors, D.C., 1—8 H.P.—5592, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

10-B.H.P. Gas Engine and Dynamo wanted; also Switchboard for same, 110 or 220 volts, D.C., separate offers considered; also 2-H.P. Motor, same voltage; also Fan, 500 c.f. of air per min., at 8" water gauge.—Full particulars and prices to 5619, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
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GEORGE BENTLEY & CO., LTD.,
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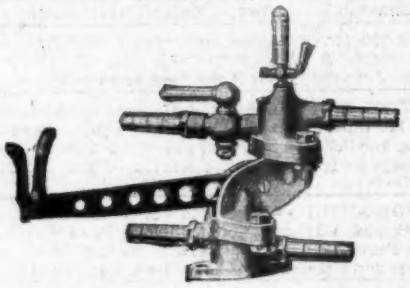
ELECTRICAL Engineer and Draughtsman is prepared to undertake, in own time, the design of electrical and mechanical apparatus; also the working out of all details ready for the manufacture of same.—5462, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHEET Metal Work Wanted, any kind; best workmanship at moderate prices.—A. V., 26, Pindar Street, Bishopsgate, London, E.C. 5626

THE 'LYONS' GAS ECONOMISER FOR OXY-ACETYLENE WELDING.

(Patent No. 3353/18.)



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DALSTON LANE, E. 8.

Session commenced 23rd September, 1918.

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Clerk of the London County Council. 2547

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(UNIVERSITY OF MANCHESTER).

Principal : J. C. M. GARNETT, M.A. (late Fellow Trin. Coll., Cam.).
Vice-Principal : E. M. WRONG, M.A. (Fellow Magdalen Coll., Oxford).

The Session 1918-1919 will open on 3RD OCTOBER. Matriculation and Entrance Examinations will be held in July and September. Matriculated students may enrol for 1918-19 from 1st August, 1918, and if under 18 years of age are eligible for membership of the Officers' Training Corps.

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See Advertisement Sept. 13th.
FILM COOLING TOWERS, LTD., 124, Chancery Lane, London, W.C. 2

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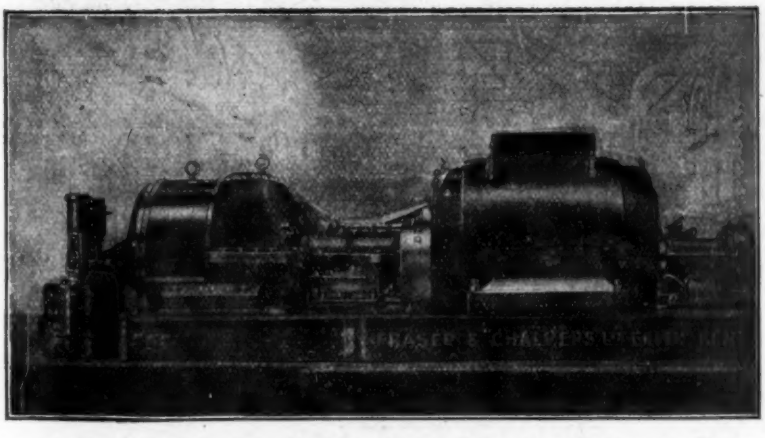

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OFFICIAL NOTICES.

Latest time for receiving 9.30 a.m. Thursday.

PORTSMOUTH CORPORATION TRAMWAYS COMMITTEE.

THE TRAMWAYS COMMITTEE of the above Corporation invite Tenders for the supply of the undermentioned goods from October 1st, 1918, to March 31st, 1919:—

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The Committee do not bind themselves to accept the lowest or any tender.

W. R. SPAVEN,
General Manager.

Town Hall, Portsmouth.
September 20th, 1918. 2671

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NOTICES RELATING TO PATENTS.

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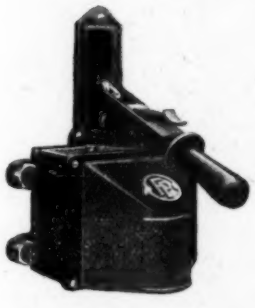

B 72.
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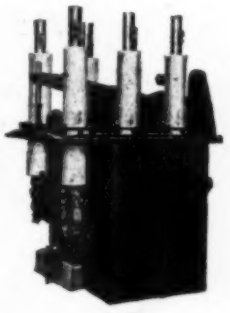

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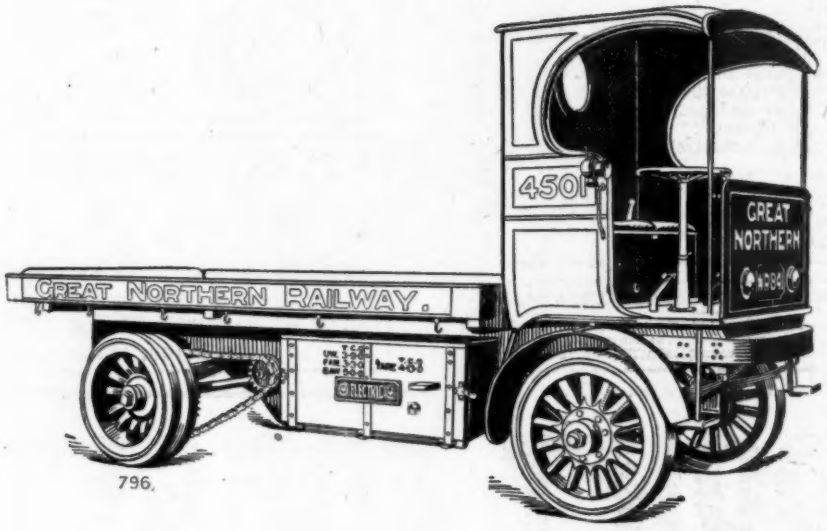

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1/20 I.R., D.C.C. BELL WIRE.
1/18 600-meg. N.A. CABLE.
3/22 600-meg. N.A. ditto.
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5 and 10-amp. Oblong CUT-OUTS.
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COUNTERWEIGHT SETS complete (Cream China).
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All-Brass SHIP FITTINGS, various designs.

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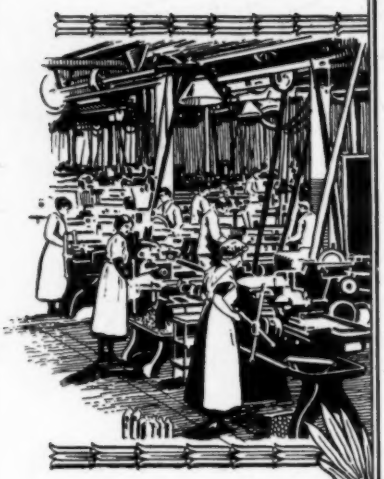

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So convinced are we that now is the time to prepare for the demands of the Post-war period that, notwithstanding the heavy calls which War Conditions make upon us, we are, even to-day, actively engaged in completing our plans for the time we all so eagerly anticipate—the time when War shall cease and Commerce resume its normal course.

As a result we shall be early in a position to deal successfully with bulk orders for all kinds of **Auto Products** and **Pressings,** and if this fact and our ability in this direction is of interest to you we ask you to share our time of preparation and get in touch.

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London: Morley House,
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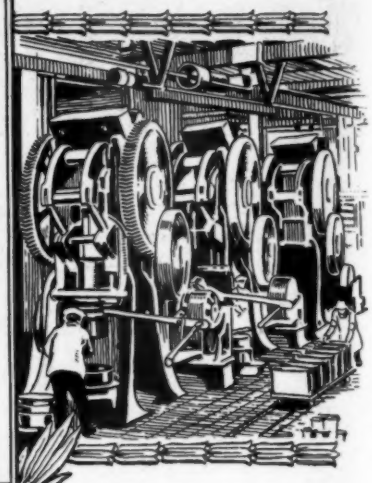

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DYNAMOS AND MOTORS REPAIRED.

CONTRACTORS TO MUNITION WORKS, CORPORATIONS, INSURANCE COMPANIES, &c.

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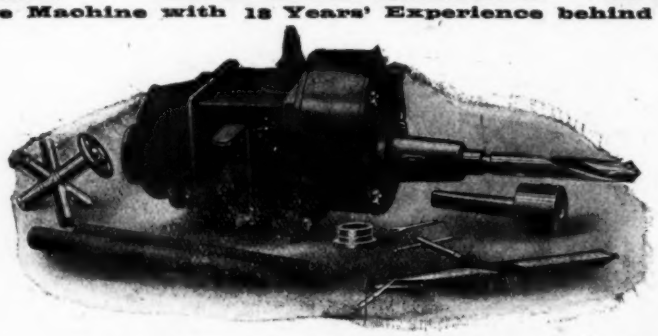
"WOLF" ELECTRIC TOOLS.

The Machine with 18 Years' Experience behind it.

We build all types of Electrical Drills of capacities from ¼ in. to 2 in.

Every machine guaranteed for 12 months.



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We also specialise in Portable Electric Grinding Machines.

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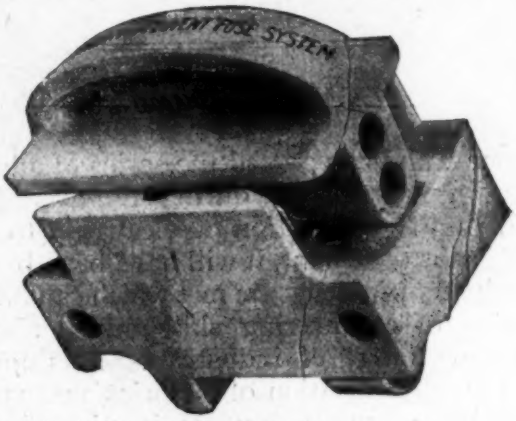
on principles which power consumers readily endorse, and proved by exceptional tests to stand up to the severest short circuits—



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15/300 Amps. FUSE

differs only from our standard FLUVENT Fuse in that it is built on a larger scale, having two main vertical tubes instead of one as on the former, so that when the fuse blows under heavy conditions the stress thus set up is distributed equally over the carrier.

Each part is accurately made to gauge—hence perfect contact of bridge with base is always secured; no portion of the actual fuse wire is in direct contact with the china at any point; its tubular fuse chamber has indestructible lining and will withstand 3000° C.; and the fuse has a perfect inverse time element.

It has our customary table printed at foot, giving details for wiring at any rating desired between 15 to 300 amps.

The FLUVENT Fuse is made in three sizes, and many other special advantages are fully explained in our Catalogue, free on request.

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Hulme Electrical Works, MANCHESTER.

London Office: 25, Victoria Street, S.W. 1. Scotland: David Alexander, Mains St., Waterloo St., Glasgow.
Birmingham & Midlands: S. Thos. Pemberton & Co., 7, Church St., Colmore Row, Birmingham.

G.E.C.

Industrial Electrification.

CONCLUSION.

TO everyone who has perused the series of advertisements appearing in these pages during the past few months dealing with the application of electricity to industry by means of "Witton" plant, it will have been brought home that in every industry problems are met which can only be solved by the application of engineering skill gained alone through contact with a wide range of industries. It is now generally realised that the electrification of factories means something more than the mere sending out of inquiries for motors of various estimated sizes and of accepting the lowest tender.

Preparatory to any selection of type or size of motor, must come a close examination of the requirements of the industry, present and future, with a view to settling not primarily how cheaply the electrical installation can be laid down, but what is the maximum rate of production which can be obtained from the plant installed. In the majority of cases the cost of electrical plant will form a small percentage of the total cost of the factory and any economy on the electrical side will be false to the highest degree.

Maximum production is what the industrial electrical engineers of the General Electric Co., Ltd., aim at, and by their knowledge not only of one particular industry but of a wide range, it is possible so to operate plants electrically that maximum production is attained, and while more may possibly have been spent upon it, the result of the care and consideration bestowed upon the electrical plant will reflect itself in a greater output per £100 spent upon the factory than if the electrification had proceeded without the assistance of their expert knowledge.

Often more depends upon the selection of the speed of the motors than the factory management will usually appreciate. Problems of starting torque which may apparently present difficulties of solution can often be settled by experience gained through the application of electricity to some other industry.

The type of enclosure to be employed for the motors is governed by considerations not widely understood, and the capabilities of each class of enclosure require such understanding as can only be given to the skilled industrial electrical engineer.

REGISTERED TRADE MARK

G.E.C.

Enclosure vitally affects the rating, which in turn determines the cost, and on this matter hundreds of pounds have often been saved in single electrification schemes through the application of expert knowledge.

The estimation of horse-power for large rolling motors and similar drives calls for a degree of skill which can only be possessed by those constantly engaged upon the work.

Starting and control problems, too, are of vital significance in the lay-out of industrial plant, and much money has been wasted in the past through installing starters of a rating excessive to that which need have been used had the expert advice of the industrial electrification engineers of the General Electric Co., Ltd., been sought. It is not generally realised that the number of starters available for industrial electrification purposes number over 100 distinct patterns, all of which are at the disposal of the General Electric Company's expert engineers.

Playing a prominent part in the success which has been achieved in the big electrification schemes laid down by the General Electric Co., Ltd., is the wealth of resources behind the engineers laying down the plant, which leaves them with an untrammelled selection of the most suitable type of apparatus, independent of political reasons for selection. Capable of supplying from their own Works the whole of the power equipment (with the exception of the boilers and condensers), of the largest undertaking that can be contemplated, the General Electric Co., Ltd., hold a position unique in the electrical manufacturing world, and the advantages of placing a contract with one firm rather than distributing it amongst a number will only be too well understood by purchasers of plant on an extensive scale.

The services of the staff of the General Electric Co., Ltd., are at the disposal of any factory electrical engineer or manager. No problem is too large or too small, and any problem involving the use of electricity, whatever direction it may take, will be handled with efficiency and satisfaction.

FINIS.

The General Electric Company, Ltd.,

Head Office: Queen Victoria Street, London, E.C. 4.

Telephones: London Wall No. 3600 (32 lines). *Telegrams:* "Electricity Cent., London."

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Liverpool—Church Alley.
Leeds—Wellington Street.
Sheffield—Angel Street.
Glasgow—Waterloo Street.
Cardiff—Womanby Street.

BRANCHES—
Bristol—Victoria Street.
Swansea—Wind Street.
Newcastle-on-Tyne—Gallowgate.
Hull—Charlotte Street.
Ipswich—Princes Street.

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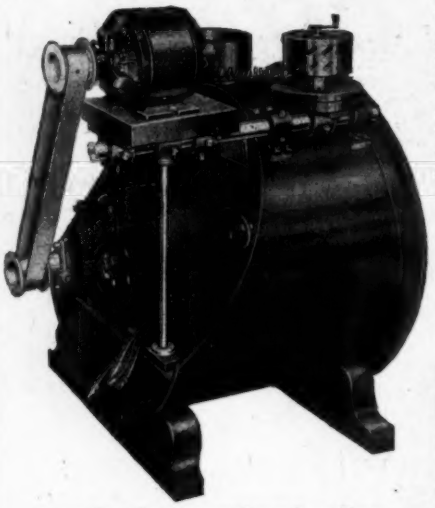
Any apparatus which will close the circuit, whether it is located close by or at a distance, is all that is required to start a——

Century

SINGLE-PHASE MOTOR.



1-H.P. Motor direct connected to an Organ Blower. These equipments are usually controlled from the keyboard of the organ by a push-button switch.

Many are in daily operation, being controlled by float, pressure and push-button switches.

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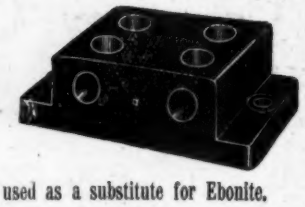

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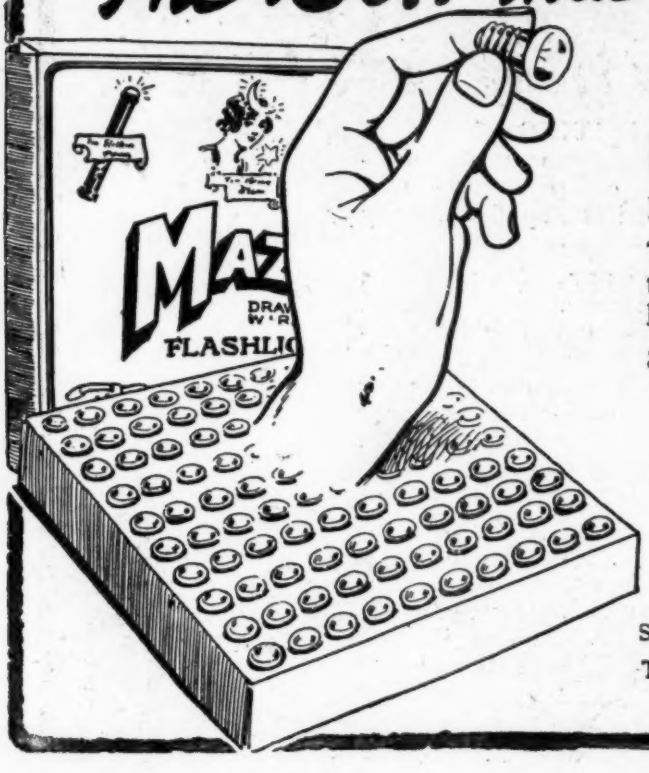

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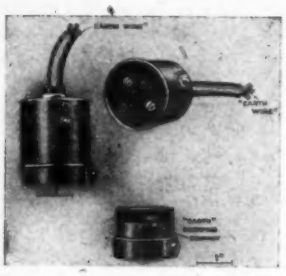

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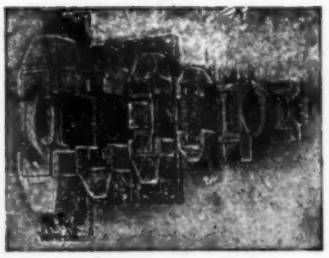

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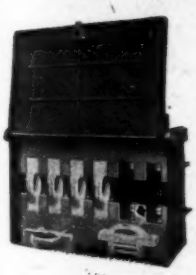
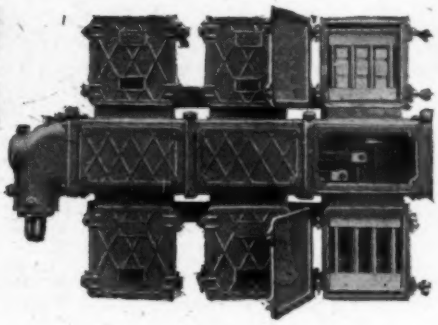
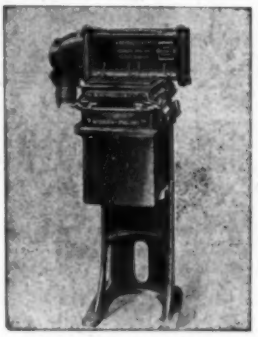
(Ironclad).







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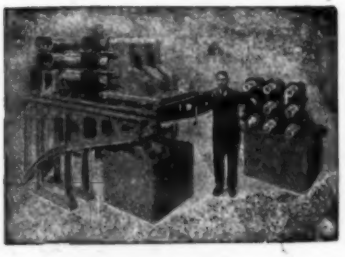
ARMOURED THROUGHOUT for all Sizes of ELECTRICITY SUPPLY SYSTEMS.



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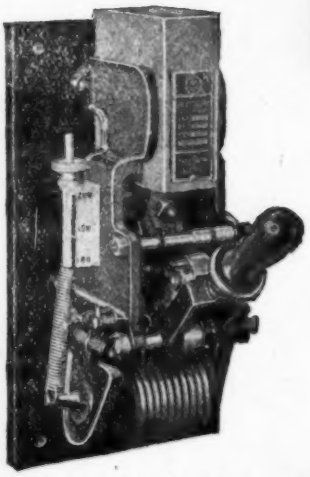

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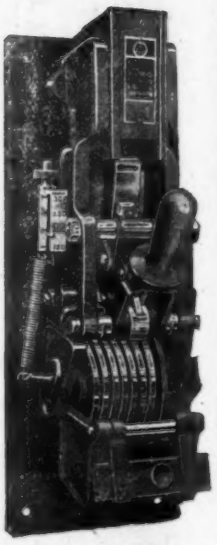

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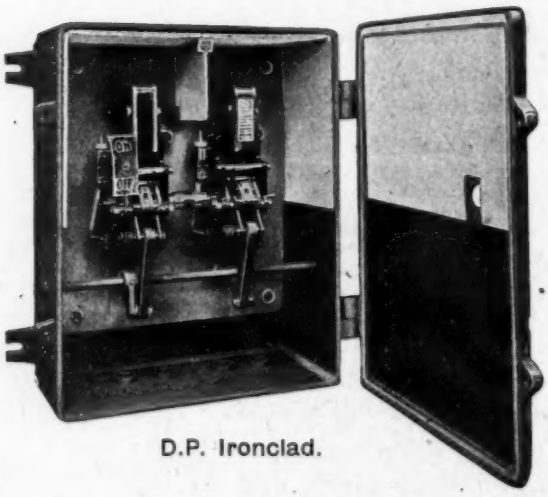

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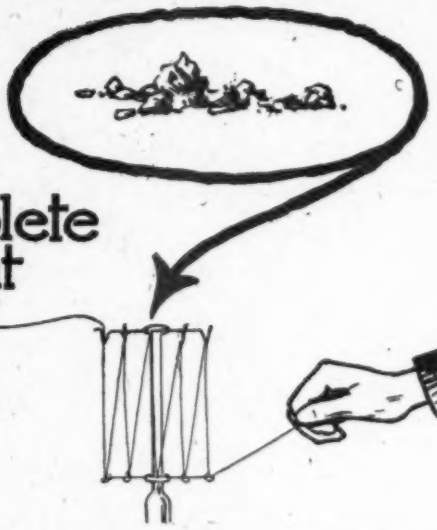
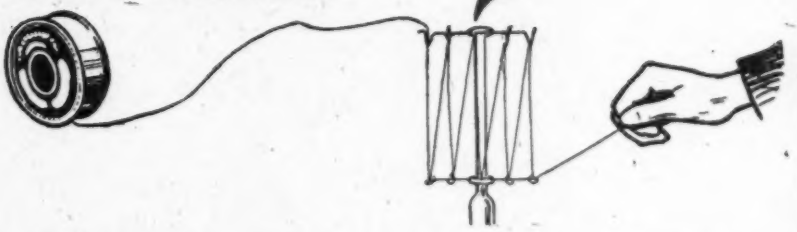


to the complete wire filament



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We begin with the Ore, refine and reduce it, work it into rod, swage it down, and finally draw down into the finest filaments.

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"Pladuram" Wire

which is the only sure guarantee of a British product from start to finish.

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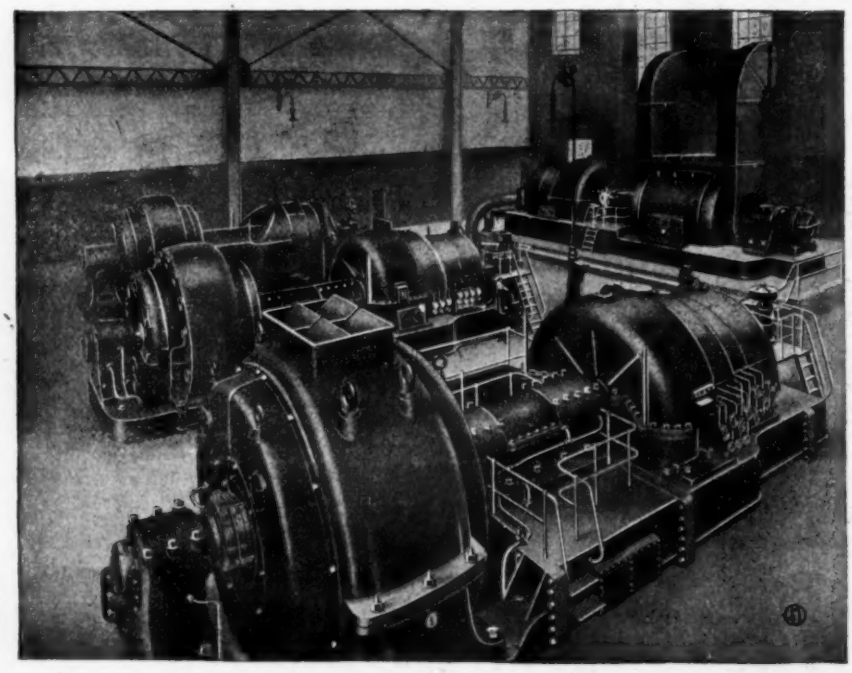

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HOWDEN'S Forced Draught.

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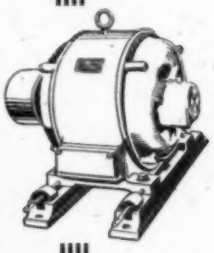
YOUR experience together with your reputation in your own particular speciality is your goodwill. So it is with us —all we are—all we have—and all we hope for, are bound up in our specialities. Single-Phase and Polyphase Motors for all industrial purposes where maximum power at a minimum current consumption is desired.

We have a very wide knowledge of this subject and our experience is available to all Power users whose propositions are such that we can assist. Will you add our experience to your own when planing extention and re-arrangements of existing plant?



We herein illustrate a Polyphase Motor. Many are in use and by the courtesy of the users may be inspected by arrangement

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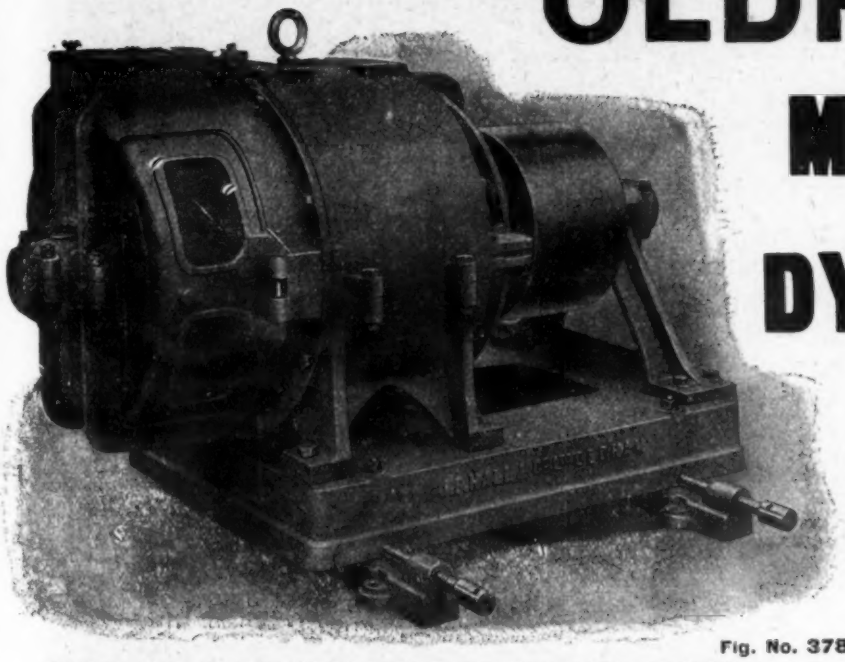

MOTORS AND DYNAMOS FOR Direct or Alternating Current.

Fig. No. 378.
50-H.P. D.C. MOTOR WITH BEDPLATE AND OUTER BEARING.

THE
'SISSON'
Patent High-Speed Enclosed
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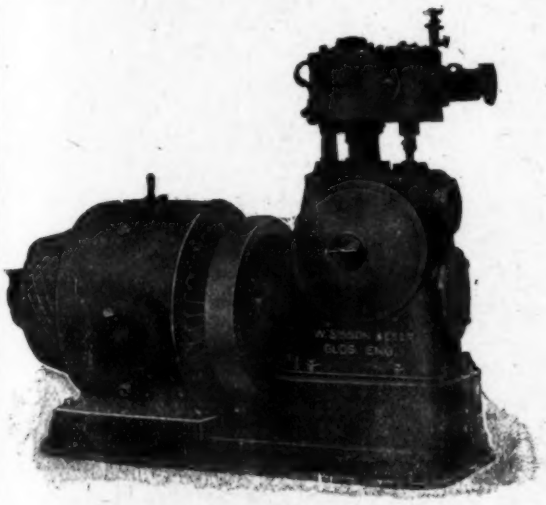
For Direct Coupling to Dynamos, Pumps, Fans, Blowers, &c.



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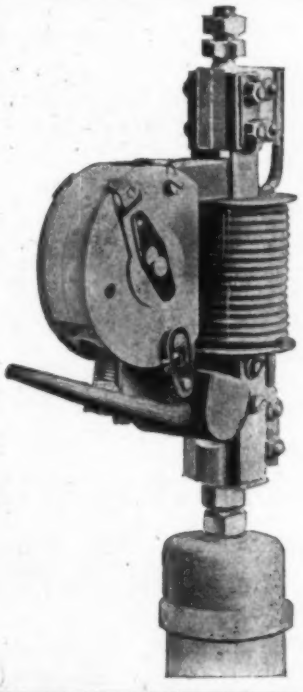

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Time of Trip is independent of Load current. No Series Transformer Required. Over 2,000 in use.

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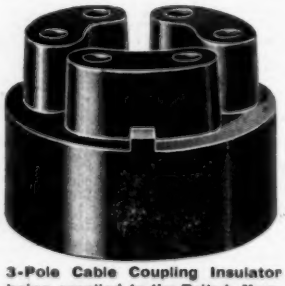

3-Pole Cable Coupling Insulator being supplied to the British Navy.

WITHSTANDS HEAT, ATMOSPHERE, HOT TRANSFORMER OIL, ALKALIES, OZONE, WATER, &c.

Rich black colour, and readily polishes.

HIGH ELECTRICAL RESISTANCE,
13,000 Volts per Millimetre.

Does not soften under any heat.

Moulded readily during manufacture into any shape.
Moulded on iron pins and into caps, etc.
Can be applied to metal parts.

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SHEET
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THE SILUMINITE INSULATOR CO., LTD.,
Telephone: SOUTHALL, 59. **The Green, Southall, Middlesex.** *Telegrams: "SOUTHALL, 59."*

Printed by WILLIAM CATE, LTD., 147-150, Saffron Hill, E.C. 1, and Published by the Proprietors, H. ALABASTER, GATEHOUSE & KEMPE, 4, Ludgate Hill, London, E.C. 4.

Grimsby.—The *Leeds Mercury* states that on September 14th the manual telephone service gave place to an installation of automatic telephones on the Siemens system. The conversion from a manual to an automatic exchange was commenced in October, 1914, but the war intervened and the work was stopped, until the need for manual switchboards at the Front led the authorities to the conclusion that if they pushed on with the automatic exchange the old Grimsby installation could be utilised elsewhere.

CONTRACTS OPEN AND CLOSED.

OPEN.

Barnes.—U.D.C. 500-KW. rotary converter, with transformers and switchgear. Electrical Engineer.

Manchester.—October 4th. Electricity Department. High and low-pressure steam and feed pipework, &c., at Stuart Street.

Portsmouth.—October 15th. Tramways Committee. Six months' supply of stores, including various electrical items. See "Official Notices" to-day.

CLOSED.

Barnes.—U.D.C. :—
E.H.T. cable.—Siemens Bros. & Co., Ltd., £885.

Government Contracts.—List of new contracts placed in August, 1918 :—

WAR OFFICE.

Chatterton's compound.—Gutta-Percha Co.; India-Rubber, Gutta-Percha and Telegraph Works, Co., Ltd.
Dynamos and engines.—Bellis & Morcom, Ltd.
Fans, &c.—James Keith & Blackman Co., Ltd.
Generating sets.—Brush Electrical Engineering Co., Ltd.; P. Cruikshanks, Ltd.; Crossley Bros. Ltd.; Day Motor Co., Ltd.; F. Gilman; Johnson, Hurley & Martin, Ltd.; Lancashire Dynamo & Motor Co., Ltd.; R. A. Lister & Co., Ltd.; A. Scott & Partners.
Magnetos.—Fellows Magneto Co., Ltd.
Motors, &c.—British Thomson-Houston Co., Ltd.; E. Brook, Ltd.; Electrical Construction Co., Ltd.; General Electric Co., Ltd.; Igranic Electrical Co., Ltd.; Maudsley's, Ltd.; F. Parkinson & Co.; Rhodes Motors, Ltd.
Transformers.—Brush Electrical Engineering Co., Ltd.

H.M. OFFICE OF WORKS.

Electric lamps.—Pope's Electric Lamp Co.

POST OFFICE.

Telegraph apparatus.—A. W. Gamage, Ltd.; India-Rubber, Gutta-Percha and Telegraph Works, Co., Ltd.; H. White & Co.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Gent & Co., Ltd.; Western Electric Co., Ltd.
Boards for telegraph sets.—Tyer & Co., Ltd.
Battery boxes.—Siemens Bros. & Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraph and telephone cable.—General Electric Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Cases for telegraph sets.—Siemens Bros. & Co., Ltd.
Secondary cells.—Hart Accumulator Co., Ltd.
Retardation coils.—Peel-Conner Telephone Works, Ltd.
Combiners.—J. Barker & Co., Ltd.
Cords for telephones.—B. I. & Helsby Cables, Ltd.; Peel-Conner Telephone Works Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Galvanometers.—India-Rubber, Gutta-Percha & Telegraph Works, Co., Ltd.
Insulators.—J. Bourne & Son, Ltd.
Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.
Suspenders for cable.—I. N. Lyons, Ltd.
Troughing.—Doulton & Co., Ltd.
Switchboard wire.—Peel-Conner Telephone Works, Ltd.
Extension of the equipment at Liverpool Bank Telephone Exchange, and provision of an exchange equipment at Liverpool Central Exchange.—Western Electric Co., Ltd.
Solder.—E. Austin & Son.—B. I. & Helsby Cables, Ltd.
Galvanised iron wire.—Whitecross Co., Ltd.

INDIA OFFICE, STORE DEPARTMENT.

Battery plates.—Chloride Electrical Storage Co., Ltd.
Cells.—General Electric Co., Ltd.
Insulator cups.—Bullers, Ltd.
Wire.—R. Johnson & Nephew, Ltd.; Whitecross & Co., Shropshire.

London.—HAMMERSMITH.—Electricity Committee :—
Two impellers' spindles, &c., for pumps for condensing water supply, £110.—Rees Roturbo Manufacturing Co., Ltd.
One impeller spindle, &c., £63.—Gwynnes, Ltd.

FORTHCOMING EVENTS.

Municipal Tramways Association (Inc.).—Friday, September 27th. At 11 a.m. At the Town Hall, Leicester. Annual general meeting.

Junior Institution of Engineers.—Friday, September 27th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecture on "The Most Important Piece of Machinery in the World," by Mr. P. Marshall.
Monday, September 30th. At 3 p.m. Visit to Messrs. Carlo Gatti and Co.'s Ice Manufacturing Plant, 120, Great Cambridge Street, Hackney Road, E.

(North-Eastern Section).—Tuesday, October 1st. At the Mining Institute, Newcastle-on-Tyne. Annual general meeting.

Industrial Reconstruction Council.—Wednesday, October 2nd. At 4.30 p.m. At Saddler's Hall, Cheapside, E.C. Address on "Commerce and Industry After the War," by the Rt. Hon. Sir Albert Stanley, M.P., President of the Board of Trade.

Electrical Power Engineers' Association (Northern Division).—(Manchester Section).—Thursday, October 3rd. At 7 p.m. Smoking concert at Grosvenor Hotel, Deansgate, Manchester.

Salford Technical and Engineering Association.—Saturday, October 5th. At 7 p.m. At the Royal Technical Institute. Paper on "Railway Electrification," by Mr. S. J. McCann.

NOTES.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, ROYAL ENGINEERS (V.).—Headquarters : Balderton Street, Oxford Street, W. 1.

Corps Orders No. 40, by Lieut.-Colonel C. B. Clay, V.D., Commanding :—
Captain of the Week.—Capt. E. G. Fleming.
Next for Duty.—Capt. W. Hynam.
Sunday, September 29th.—Commandant's Parade, at Waterloo Station, 8.45 a.m. (opposite No. 9 Platform), for work at Esher. Dress: Drill order, without rifles. Mid-day and tea rations to be carried.
Monday, September 30th, to Saturday, October 5th.—Drills as usual.
Sunday, October 6th.—Annual Musketry course at Pirbright. Parade, Waterloo Station, 8.45 a.m. Dress: Drill order, with rifles and side arms. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

A Technical Commission for German Copper Supply.—The president of the general meeting of the German Association of Metal and Mining Engineers (Gesellschaft Deutscher Metallhütten und Bergleute), recently held in Berlin, announced the formation of a special commission composed of expert members to consider and report on the question of securing a future supply of copper, says *Metall und Erz*. The experiences of the war have shown with impressive clearness the necessity of making the Fatherland independent of imports of copper. Every possibility in that direction will be carefully and thoroughly considered by this Commission, which was suggested, and which will be directed, by the Association.

British Oil.—Boring operations are expected to commence shortly on sites near Sheffield and Chesterfield, by Messrs. S. Pearson & Sons. It is stated that the cost of drilling a single bore under the most favourable conditions is between £30,000 and £40,000, and that a 15-in.-diameter, 4,000-ft.-deep bore is about to be commenced. In the Derbyshire district, oil is most likely to be found at a depth of 2,000 ft. It is hoped to get from this district a crude oil heavily charged with benzine, paraffin, and other valuable by-products, which will be distilled before the heavier product is sent to the Admiralty for naval use as fuel.

Fuel Economy.—According to the daily Press, the Coal Controller has issued the following statement :—"A large number of experts have been appointed to advise steam-power users how to eliminate waste. It will, however, take several years to recover the whole of the loss that is going on, as it is impossible to install more efficient plant during the war. Another cause of waste is the employment of unskilled stokers. Saving can be effected, without drastic alteration to plant, in the following directions :—Obtaining greater efficiency in the combustion of fuel ; education of stokers ; utilising the hot gases to better advantage ; using exhaust steam for feed-water heating ; more efficient utilisation of steam generated ; using condenser discharge for boiler feed ; effective lagging of steam pipes ; and disconnecting steam pipes not in use." Of the 45,000 users of steam plant in Great Britain, 364 firms have been carefully scrutinised and reported upon, and it is estimated that a saving of approximately 106,000 tons of fuel will result.

Electrolytic Disinfecting Fluid.—During the year 1917, according to the report of Dr. F. W. Alexander, Medical Officer of Health to the Borough of Stepney, 27,900 gallons of electrolytic disinfectant were manufactured, making 55,800 gallons as diluted for distribution. The cost was for materials £75 ; electrical energy, £45 ; total, £120. Since the installation of the plant, a period of 12 years, 473,469 gallons of fluid have been manufactured at a cost for electricity of £535 and materials £531 (about ½d. per gallon). The report states that, in spite of adverse criticism, the process has been a great success during the whole period of its installation.

Fuel Economy.—The *Electrical Review* of Chicago states that coal conservation to an astonishing degree is the result of the discontinuance of 24 privately operated plants in Chicago, and the consequent operation of their systems by central station service. The estimated saving in coal occasioned by this change reaches the excellent total of 54,840 tons a year. By these plants taking over central station service a total daily requirement of 2,172,000 KW.-hours has been added to the Commonwealth Edison Co.'s operating system—a figure that approximates an addition of nearly 17,000 H.P.

In addition to the above, the power division of the Commonwealth Edison Co. has closed, since January 1st, some 48 contracts calling for large installations on the company's lines. The estimated annual coal saving made by these plants using central station service is approximately 100,545 tons. It also means a service addition of 8,190,000 KW.-hours, or 47,663 H.P.

The Wild-Barfield Furnace.—In our issue of Sept. 20th we referred to the utilisation of "the remarkable change in the molecular constitution of steel at the temperature of recalescence" in connection with the hardening of steel. Messrs. Automatic and Electric Furnaces, Ltd., write pointing out that their process takes advantage of the correct determination of the *decalescent* point, and that our use of the term "recalescence" is misleading. We agree that this is so, for though both expressions relate to the same temperature, the term "decalescence" indicates that that critical point is reached with a rising temperature, the condition which we had in mind.

Copper Discovery in Russia.—According to a Reuter dispatch from Amsterdam, in the Government of Kurak a great copper lode has been discovered bearing 58 per cent. of ore. Preparations are going on for working the deposit.

The Coal Shortage.—The seriousness of the coal situation was further explained by Sir Albert Stanley, President of the Board of Trade, at a conference of London and home county mayors at the Mansion House on Friday last. "The fuel problem is an exceedingly grave one," he said, the shortage of coal being about 36,000,000 tons. By the present rationing scheme it was hoped to save something like eight million tons, which would still leave a deficit of 28 million tons, the imperative need for economy would therefore be appreciated. In March last we were confronted with the immediate and unanswerable demand for more men for the Army. That meant the withdrawal of 100,000 men from the mines. Because the Americans were coming over in such large numbers that was no reason why men should be withdrawn from the Army to be returned to the mines. Every man, be he British, American, French, or Belgian, was needed at the front. Sir Albert asked for the help and co-operation of all consumers in economising fuel of all descriptions; there was no surplus of anything in the country at the present time, and it would be useless to economise in coal consumption, only to consume other fuels and substitutes in place of it. An all-round economy of every class of fuel would have to be made. We could hardly ask the miners to make sacrifices by working longer hours and producing greater outputs if consumers would not make correspondnig sacrifices by consuming less fuel.

Electric Arc Welding.—Mr. R. E. Kinkead's paper in the *Journal*, Cleveland Engineering Society, is confined almost entirely to the use of electric arc welding in locomotive shops, and a paper by E. Wanamaker is also submitted. The object of this paper is to show how electric are welding can assist the war problem in increasing the efficiency of locomotives. It describes the portable plant used by the Rock Island Railroad Co., where a number of such portable plants are used, with the advantage that they can be transferred from one point to another, and thus prevent any congestion. There is a lengthy table comparing in respect of cost electric welding with the old methods and with gas welding (oxy-acetylene) for practically every part of the locomotive. In some cases the reduction in cost is very great, as for example:—

	Old Method.	Gas Welding.	Electric Welding.
	$	$	$
Cross heads	356.40	120.23	37.73
Wheel spokes ...	1,276.80	113.08	35.08
Plugging and building up holes ...	349.69	280.94	140.47
Steam pipes	3.79	5.12	2.12
Flat spots on tires ...	99.86	95.77	29.77

It is estimated that the use of 150 portable plants would save $1,000,000 per annum. Similar portable plants have been sent over to France, and are there in use to a large extent. It is mentioned that new caulks to horse-shoes can be replaced without removing the shoe from the horse's hoof. In the discussion many questions were asked in respect of fusing steel and cast-iron together. The author answered that it could be done, but great difficulties arose in practice owing to contraction of the cast-iron, and by the absorption of carbon by the steel. Brass cannot be welded electrically owing to the zinc which volatilises immediately, but bronze can be welded to steel most satisfactorily. A method of welding copper wires together by using a ferrule slipped over the wire was stated to give good results. Where it was desirable to localise the heat, metal electrodes are preferable to carbon. The use of the arc for removing sand spots out of castings is described. It is stated that manganese steel can be repaired by welding, and the steel put in by the arc contains 12 per cent. of manganese.

Testing Metals by Means of X-Rays.—In *Stahl und Eisen* appears an article describing the physical nature, properties, and production of X-rays, so far as these are required for the testing of metals. Hard rays produced from, for instance, a Coolidge tube of spark-gap 27—42 cm. (equivalent to a potential difference of 180,000 to 240,000 volts) are best suited for the work. Blowholes have been detected in masses of steel 10-12 cm. thick. Visual examination with the fluorescent screen is not possible for sheets of metal thicker than 2 or 3 mm. Larger masses must be investigated photographically, with the aid of a calcium tungstate intensifying screen placed in close contact with the film. To minimise the disturbing effect of secondary radiations the sample should be surrounded by a layer of lead cast around it. This protection must be thicker as the sample increases in size; for very thick specimens a layer 15 to 20 mm. thick is required. For investigating special portions of metal, secondary radiations are best excluded by placing a thick lead tube of sufficient diameter above the region with another of shorter length between the specimen and the plate. This plate is made with a thick and very rich emulsion, which requires a much longer time of development than an ordinary plate, a glycine developer being recommended. A high-tension step-up transformer giving 120,000 to 150,000 volts is, it is stated, far better than an induction coil as a source of energy for the Coolidge tube. To minimise risk in such work the tube should be placed in a box with a thick lead lining and operated from another room, a small lead-glass window being provided for observation. The depth of flaws may be measured by making two exposures on the same plate with the tube moved horizontally a known distance. The distance apart of the two shadows then allows the depth to be calculated if the distance of the plate from the anti-cathode of the tube is known.

Electric Pump Control.—It appears, according to the *Financial News*, that in Germany trouble has frequently been experienced in connection with the electrical control of pumping motors. These were generally governed by automatic depth-actuated devices fixed at the reservoir, which cut out the motor as soon as the water had reached the required height. In a leading German paper an account is given of the Wolf apparatus recently installed at Schweinsburg, on the River Pliesse, Saxony, which so far has given complete satisfaction. An electric motor is direct-coupled to a centrifugal pump, close to which a large air vessel is fixed on the delivery pipe. On the top of this air chamber is a switch. A closed cylindrical tank is fixed at the other end of the delivery pipe, provided at the top with a small fitting, to which is attached an air release pipe. As soon as a certain pre-determined quantity of water is drawn off from the tank the air pressure in the switch-operating chamber is released, and the starting switch is closed by a spring. In plants of fairly large size the air release puts a relay circuit in action and the switch is closed by means of a positive electro-magnetic device. The pump at once commences to deliver water until the storage tank is filled, when the increased head of water compresses the controlling spring, which in turn opens the switch. It is reported that one of the largest German railways has adopted the method in connection with its locomotive supply tanks. According to recently published figures, nearly 3,500 gallons of water per hour can be delivered to a height of roughly 110 ft. at an expenditure of under 3¼ KW. per hour.

A Large Electric Crane.—In the *American Machinist* of September 21st a description is given of one of the largest electric travelling cranes ever built, which was recently shipped from the shops of the Alliance Machine Co., Alliance, Ohio, and required 16 freight cars for its transportation. Notwithstanding its huge size and the many unusual problems which were involved in its design and construction, because of the large loads to be handled, the wide variations in hoisting and lowering speeds, and the necessity for extreme accuracy of control, the crane was completed in a period of approximately nine months.

The total lifting capacity of the crane is 431 net tons, of which a weight of 336 tons is handled by the main hoist, 90 tons by the first auxiliary hoist, and 5 tons by the second. When installed this crane will occupy a position above two similar cranes of 300 tons capacity each, these latter being now under construction at the Alliance plant.

The main hoist is designed to secure accurate control, and for this reason the main trolley carries two drums driven by two trains of gearing acting together, thus eliminating the possibility of a swinging movement being imparted to the load. Both dynamic and jackshaft braking are employed in the special braking apparatus, which is so designed and arranged as to allow the operator to lower the load ¼ in. at a time. The hoisting and lowering speed under full load is 12½ ft. per minute. The main hoist is operated by two 200-H.P. motors, ensuring unusual safety of operation, as in case of emergency one motor can for a short time handle the full load alone. The two motors are coupled together to avoid any variation of speed. The auxiliary trolley, which is entirely independent of the main trolley, is of special design to meet the specifications in regard to speeds of the two separate hoists which are carried upon it; these speeds vary from 2 to 45 ft. per minute, and are controlled by a special magnetic clutch and reduction gearing. The crane runway is 120 ft. above the ground level, and the maximum lift is 100 ft. The span of the bridge is 90 ft. 4 in., and that of the trolleys 18 ft. The main trolley carries an 80-H.P. motor for the traverse, while a 30-H.P. motor serves the same purpose for the auxiliary, the speed of the traverse being about 45 ft. per minute.

The bridge is carried by 32 wheels, 30 in. in diameter, running upon a double runway. Two 50-H.P. motors acting independently supply the motive power, which is transmitted through one pair of wheels at each corner of the bridge, or eight wheels in all. The trolley and bridge trucks are designed to oscillate in all directions to compensate for any deflection caused by the load. The height from the bottom of the main hoist-hook block to the top of the block is 12 ft.

A Week-End at Blackpool.—The members of the Blackpool branch of the Electrical Trades Union, comprising practically the whole of the electricians working in the town, struck work last week-end, owing to a dispute which had arisen over the payment of war bonuses to apprentices. The trouble concerned an award of the Committee on Production, and it was agreed to submit the points at issue to Mr. L. Tate, secretary of the National Federated Electrical Association. He decided in favour of a bonus of 6s. 6d. per week for youths under 18 years of age, and 10s. 6d. per week for those over that age, to date from May 24th last. This bonus was not paid, however, and, following a fortnight's notice, the men downed tools. The employers consented to pay the bonus, with a further 1s. 9d. per week to all apprentices from August 10th, and the men returned to work on Monday morning.

Static Electricity—According to *Indian Engineering*, an electric neutraliser has been invented that does away with the static charges experienced in printing operations. By means of a small motor-generator, A.C. current is supplied at about 70 volts pressure. This is transformed up to a high voltage at low current for delivery to the paper through distributing bars on the printing press. These bars are composed of a number of fine metal points set in porcelain insulators. A bar is located near the cylinder and drop guides, and, if necessary, one is attached to the delivery. As the sheets pass under a bar, the charge of static electricity is neutralised.

The Schoop Metal-Spraying Process.—From Zurich comes the news of another improvement in the Schoop process, says *Engineering*. Instead of melting the metal, which is generally applied in the shape of a wire, by the oxy-hydrogen flame or the blowpipe, electric fusion is now used, and is said to be both simpler and cheaper. The pistol apparatus is used as before; but two ends of the wire are placed in the pistol, instead of one, and they are approached to one another as electrodes of an electric circuit. When the arc strikes, the wire fuses, and the air current tears the fine metallic particles away. Zinc sprays in particular have been produced in this way, according to Kasperowicz (*Zeitschrift für Angewandte Chemie*, July 23rd, 1918). The electric heating may be simple, but the prevention of the oxidation of the sprayed metal will probably be as difficult as before.

Electric Furnace for Melting Alloys.—A brief account of a Heroult furnace for the preparation of nickel alloys, in the August 17th issue of the *Electrical World*, by W. H. Easton, gives a capital idea of the special applications of electric heating which are coming rapidly into use. A furnace of this sort requires comparatively small energy at the start, but a large and fluctuating quantity when the melt is well under way. At this point the changes in furnace resistance are great and rapid, including many momentary and some persistent short circuits. High momentary overloads are characteristic of this kind of electric furnace work and require exceptionally good regulation to keep the variations of load within bounds. In this case a very ingenious Thury regulator has been installed to maintain automatically as nearly as possible a constant current at the electrodes. Each electrode is regulated separately, being provided with a motor to raise and lower it. Whenever the current from the electrode exceeds the limit set, a momentary contact starts its motor and withdraws the electrode slightly, repeating the operation step by step until the current is down to its proper limit. With a current too low, the electrode is in a corresponding fashion pushed in to the required point. Series transformers in the main high-tension circuit furnish power to the solenoid control for the regulator. There are two 400-K.V.A., 2,200/110-volt transformers of the oil-insulated, self-cooled type. They are T-connected so that they change the high-voltage two-phase current into low-voltage three-phase current, one phase for each of the three electrodes of the furnace. Special construction is necessary to withstand the overloads. These overloads are of such short duration that their heating effect is negligible, but they tend to force the coils apart. Hence the coils are very firmly braced and are capable of withstanding momentary overloads fifteen times greater than the normal load. The regulating motors for the electrodes are operated by direct current, by reason of the delicacy of the control thereby obtained, a small motor-generator set furnishing the necessary power. Each electrode motor is equipped with a controller for manual operation if necessary.

Electric Cooking in America.—The Southern California Edison Co., which, by the way, has more electric ranges on its lines by over 1,000 than any other central station in the United States, sold over 3,000 electric ranges in the period of 2½ years ended May 1st, 1918, an average of 100 ranges per month. Owing to the changed conditions on account of the war, it became necessary to analyse closely all classes of business development and to discontinue any that might be termed experimental or unprofitable. With this in mind, a canvass was made of the electric cooking situation and the value of the load.

Recently a list of questions was sent to each district agent regarding electric range installations and service, and some of the replies received are as follows:—

(*a*) "What percentage of consumers using electric ranges in your district are satisfied with the service? This, of course, means the utility of the range and the size of the bills." The replies indicated that over 95 per cent. of electric range consumers were satisfied.

(*b*) "As a result of your experience, what do you consider are the strong points in the use of the electric range—that is, what commends the electric range to consumers?" Replies mentioned the following points, given in the order of importance:—Cleanliness, convenience and ease of operation, absence of heat in summer, safety, saving of food and retention of flavour, automatic feature, no smoke, cost of operation, hygiene, accuracy.

(*c*) "What do you consider are the weak points in the use of the electric range—that is, what features are a trouble or annoyance to consumers?" Replies given in order of importance:—Burn-outs of elements, burn-outs of fuses, slow top-burner heating, bricks cracking, broken switches, discoloration of oven linings, replacements too slow, unreliable thermostats, leaky oven doors.

(*d*) "Have you any suggestions to make which might tend to improve the utility of the electric range?" The suggestions were numerous, and those from different parts of the system were remarkably similar. Some of these were:—More heat in at least one top burner, plenty of replacements on hand, non-rusting ovens, extra simmering burner, pilot light, units more rugged and reliable, steam vents.

Of the total number of electric ranges sold on the Edison system, only 155, or about 5 per cent., are installed in apartment houses. Experience has demonstrated that, while the apartment-house load can be satisfactorily handled, it causes the company probably four times as many troubles per range in use as do installations in private houses. Apparently the average tenant in an apartment house does not take so much interest in keeping the range in good order as does the owner of a private house. Further, the apartment house occupants frequently come and go, and, as a rule, they do not study electric cooking sufficiently to get the best results. Consequently, the trouble-man and the demonstrator have to make frequent visits to apartment-house installations.

The reports concerning the operation of 3,000 electric ranges on its system have demonstrated to the Southern California Edison Co. that (*a*) the electric cooking load is a desirable load if the rates for service are equitable; (*b*) the electric range is satisfactory to its consumers; and (*c*) electric cooking service is along the lines of conservation of both food and fuel.

The prospective expense is by no means overlooked by new consumers, but most of them know what it is actually costing some friend or neighbour. Then, again, the knowledge of the compensating advantages of electric cooking is spreading. Gas may be a cheaper means of lighting than electricity, yet in most localities the public insists on electric lighting where it is available. There are strong indications that the same preference will be developed for electric cooking.

Under normal conditions the Southern California Edison Co. would have sold 2,000 electric ranges in 1918, and could have accomplished this task more easily than it could have sold 500 ranges two years ago. Satisfactory progress has been made in building up a cooking load on the company's system, and under more favourable conditions every reasonable effort would be made to increase the load as rapidly as possible. Until conditions change the business already connected will be nursed and cultivated, so that when the right time arrives there will probably be an insistent demand for electric ranges resulting from the advertising done by present installations.—*Electrical World*.

Electrical Power Engineers' Association.—This Association, which is the recognised protective organisation for staff engineers engaged in the generation, distribution, or utilisation of electrical energy, has been compelled, owing to the influx of new members, to sectionise further the Southern Division. During the past week there have been inaugurated the following Sections:—South Coast Section, to meet at Brighton; hon. sec., Mr. W. G. Gibbons, 8, St. Andrew Road, Portslade-by-Sea. London Central Station, to meet at King's Cross; hon. sec., Mr. E. N. Christmas, 55, Calabria Road, N. 5. London South-Eastern Section, to meet at New Cross; hon. sec., Mr. E. W. Martin, 169, Well Hall Road, S.E. 9.

MANCHESTER AND DISTRICT SECTION.—A new Committee has been elected for this Section, and the following officers have been appointed:—Chairman, Mr. A. L. Lunn, of Manchester, president of the Association; vice-chairman, Mr. E. H. L. Dickson, of Salford; hon. secretary, Mr. E. B. Pansey, 5, Newhall Road, Jericho, Bury; hon. treasurer, Mr. G. Fry, 25, Powell Street, Old Trafford, Manchester.

A smoking concert will be held at the Grosvenor Hotel, Deansgate, Manchester, on October 3rd, at 7 p.m., to celebrate the anniversary of the inaugural meeting of what is now the E.P.E.A. at Manchester. The Committee cordially invites all members and possible members to be present.

A general meeting of the members of the West Yorkshire Section was held at Leeds on Saturday, the 21st inst. Mr. J. E. Ellis, of Morley, was in the chair, there being 70 members present, including the full Committee, the president (Mr. A. L. Lunn), and one of the vice-presidents (Mr. R. C. Atkinson). A general review of the progress of the Association was given, also a detailed account of the activities of the West Yorkshire Section since its formation. It is intended to hold during the winter session a series of meetings for members, and a programme drawn up by the Sub-Committee was submitted.

Electric Industrial Trucks.—In an article on industrial electric trucks in the *Textile Recorder* of September 14th, Mr. R. Douglas-Vickers says that we have to recognise that the field for development is an immense one, and that whatever may be done in the way of converting to industrial electrics during the war will still leave a big area untouched. The difficulty in getting adequate supplies constitutes one factor in the limitation of expansion, but wherever they are put in they are rapidly proving their utility and economy. As a means of easing the labour situation, German factory owners have for a long time been making use of the industrial electric truck and tractor. That they have been doing so upon an extensive scale is clear from references which have, from time to time, appeared in their technical Press. There is little doubt that the old methods of inter-shop transport, with their many disadvantages, especially their labour wasting propensities, are being eliminated in most up-to-date establishments. The author briefly describes the "Hunt" range of industrial trucks and tractors, which are equipped with either Edison or Ironclad Exide storage batteries. These outfits are built by the C. W. Hunt Co., of New York City, and are marketed in the United Kingdom by Messrs. Irwin & Jones, Ltd., London House, New London Street, London, E.C.3. They are made in three types, but they are all of the same carrying capacity—two tons, which should be adequate for every factory's internal transport requirements.

Educational.—THE POLYTECHNIC, Regent Street, London.—We have received particulars of the courses of instruction for the coming session, which commences on Monday, September 30th. Mr. W. Hibbert, A.M.I.E.E., is at the head of the department of Electricity, Electrical Engineering, and Physics. Special courses are provided in Telegraphy and Telephony.

Electromedical Progress.—*The Times* mentions that 1,818 military cases were treated in the new electromedical department of Willesden Cottage Hospital, last year, as compared with 123 in 1916.

Inquiry.—A correspondent asks for the makers of "Zyrolite" insulating material.

Irrational Regulations.—In a letter to the *Times*, headed "Ration Regulations," a lady correspondent says :—

A short time ago a printed paper issued by the Ministry of Food, "F.S.B. 26, August, 1918," entitled "Housekeeping under the Fuel Rations," was sent to me, wherein I read the following :—

"It is unnecessary to use electric light for passages, bathrooms, or bedrooms. A candle would be amply sufficient, or a nightlight where continuous light is not needed."

In the *Times* of Monday, September 16th, I read the following :—"The Food Controller wishes to point out that the use of candles and lamps in bedrooms and other parts of the house where there is gas or electricity is an unpatriotic action. If this growing practice is not stopped, there will soon be a famine in paraffin and candles." I am honestly most anxious to carry out the directions issued to us by the authorities. But I confess that I find a difficulty in complying with both of the above requests at the same time.

Patents and Alien Enemies.—The Board of Trade has granted licences in respect of Patents Nos. 9,650/08 (Woerner) and 22,857/10 and 23,251/10 (Bosch), to the London and North-Western Railway Co.; and in respect of Patent No. 563/10 (Sauter) to Messrs. Davy Bros., Ltd.

Appointments Vacant.—Electrical engineer and manager (£300) for the Darwen Corporation electricity undertaking; shift engineer (65s. + 12½ per cent.) for the Leigh Corporation electricity works; charge engineer (73s.8d.) for the Wakefield Corporation electricity department. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Hull Corporation Electricity Committee has decided to advance the salary of Mr. MAGORIS, the acting engineer, who has completed four years' service in the absence of the engineer (Mr. Bell) on military service, from £425 to the figure normally attached to the position that he has been occupying, namely, £700.

Hackney B.C. Establishment Committee recommends that the increase of salary due to Mr. J. F. HEATHMAN, chief clerk in the Council's electricity department, in 1919, be paid as from September, 1918.

Mr. T. CLAY, inspector on the York Corporation tramways, who has joined the R.A.F., has been presented by the staff with a hanging clock.

The South Shields Council has recently increased the salary of Mr. HARRY T. ELLIS from £550 to £700 per annum by one advance of £150.

At the Willesden Electricity Committee, the electrical engineer reported that, at the request of the Coal Controller, he had nominated Mr. C. C. BUTLER, as representing the electricity department, to co-operate with the Fuel Overseer under the provisions of the Fuel Order. The electrical engineer had, at the special request of the Coal Controller, agreed to assist him in the coal economy campaign with reference to factories in the district.

Hammersmith B.C. Electricity Committee recommends that Mr. G. G. BELL, the borough electrical engineer, be allowed to act as district engineer to assist the local technical representative in the coal economy campaign.

Mr. DUFFY, of Wolverhampton, who had been appointed temporary engineer-in-charge at the Hammersmith Council's electricity works, has decided not to take up the appointment.

Mr. F. SWARBRICK, electrical engineer and manager to the Leek U.D.C., has been appointed district engineer to the Board of Trade (Coal Mines Department), in connection with the coal economy campaign.

The Heston and Isleworth E.C. has appointed Mr. E. BROAD, senior engineer in charge, to the post of assistant station superintendent, and empowered the manager to appoint a shift engineer in the place of Mr. Broad, at £3 7s. 6d. per week.

General.—It is announced that, owing to the condition of his health, Dr. E. K. MUSPRATT has resigned his position as chairman of the British Insulated & Helsby Cables, Ltd., and Mr. James Taylor has been elected chairman in his stead. Dr. Muspratt will remain as an ordinary director, and Sir Alexander Roger has been elected to the board.

Barnsley Higher Education Committee has appointed Mr. W. B. STEELE, as instructor in mine electrical work at the technical school.

Lieutenant F. W. MOZLEY, R.E., son of Mr. Mozley, Burnley tramways manager, has been promoted to the rank of captain.

Mr. A. M'KINSTRY, who has been appointed a member on the Australian Directorate of Munitions, was general manager in Australia of the British Westinghouse Electric and Manufacturing Co., Ltd.

Mr. GEORGE SUTTON, of Beckenham, chairman and managing director of W. T. Henley's Telegraph Works Co., Ltd., has sent to the President of the Dickens Fellowship £5,000 in 5 per cent. War Loan bearer stock to be applied to the endowment of the Charles Dickens Home for Blinded Soldiers and Sailors.

The *Electrical World* states that Colonel GUY E. TRIPP, recently chairman of the board of the Westinghouse Electric and Manufacturing Co., who was given leave of absence by the directors of the company in order to devote himself to the U.S. Government service for the duration of the war, has been appointed Brigadier-General. From chief of the production division of the Ordnance Department of the Army, General Tripp has just been promoted to be assistant chief of the Ordnance Department.

Roll of Honour.—Second-Lieutenant W. S. THAIN, Royal Warwickshire Regiment, who was accidentally drowned in France on September 15th, was in the service of the General Electric Co., Witton, for seven years, and was in charge of the electrical laboratory of the Midland Railway, at Derby, for about a year before enlisting in the R.E. in 1915.

Sergeant H. WRIGHT, Essex Regiment, who has been killed in action, was an inspector on the Colchester municipal tramways.

Private J. W. CASEY, Machine Gun Corps, who has died of wounds, was on the Croydon municipal electricity staff.

Drummer R. LANDERS, Manchester Regiment, killed in action, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Corporal G. BOWDEN, Lancashire Fusiliers, killed in action, was an apprentice with the British Westinghouse Co., Trafford Park.

The death is reported, from wounds received in action, of Second-Lieutenant JOHN A. MOFFAT, R.E., who was an electrical engineer, and well known in electrical circles in Scotland, he having been for some years prior to the war Scottish representative for Messrs. Ferranti, Ltd.

Gunner W. MOXON, R.G.A., who was in the electricity department of the Rotherham Corporation, has been dangerously wounded.

Mr. F. A. BASSETT, of the Merchant Fleet Auxiliary, who has been accidentally killed on service, was a senior electrical engineer on the Tyne.

Corporal T. JEMSON, L.N.L. Regiment, killed in action, served his apprenticeship with Messrs. Dick, Kerr & Co., Preston.

Private J. E. LITTLER, East Lancashire Regiment, who has fallen in his 23rd year, was employed by the B.I. & Helsby Cables, Ltd.

Private T. R. CROWCROFT, K.O.Y.L.I., who has been severely wounded, went at the outbreak of war from his post at the Scarborough electricity works to rejoin his old regiment. He has been mentioned in dispatches for the Military Medal.

Wireless Telegraphist RICHARD HOLDSWORTH, R.N.V.R., lost his life in endeavouring to save Lieutenant H. Law, R.N.R., during the sinking of His Majesty's trawler *Achilles II* in June last. The *Achilles II*, while mine-sweeping, struck a mine and sank in a few minutes, the captain and 12 members of the crew losing their lives. Just after the explosion Holdsworth found Lieutenant Law in a dying condition near the winch, and at once endeavoured to get him to the side of the vessel in the hope of obtaining assistance. Twice the telegraphist was told to leave the ship and save himself, as it was then apparent that the lieutenant was dead. He was, however, persisting in his endeavour to remove the body when the vessel sank. Holdsworth, who by his devotion to the officer, had not had time to put on his lifebelt, was drowned, after having sustained injury.—*Daily Telegraph*.

Obituary.—MRS. B. BRYDEN.—Electrical readers of the *Times* for September 20th will have noted the following with feelings of deep sympathy and regret :—

BRYDEN.—On September 12th, 1918, lost from the torpedoed liner *Galway Castle*, Beryl, the dearly-loved wife of Charles Lumsdaine Bryden, head of the electrical department of the Victoria Falls and Transvaal Power Co., Johannesburg (and younger daughter of Major-General Isaac Ketchen, Royal Artillery), aged 40 years; and also their younger daughter, Cecil, aged three years and nine months.

DR. B. W. FEDDERSON.—The death recently occurred at Leipzig, at the age of 87 years, of Dr. Berend W. Fedderson, a leading German electrician, who is claimed to have laid the foundation for all subsequent research of the subject of electrical oscillations between 1857 and 1866.

DR. F. BRAUN.—The death has recently occurred in the United States, whither he journeyed early in 1915, of Dr. Ferdinand Braun, formerly Professor of Physics in the University of Strassburg, Germany. He had devoted considerable attention to the development of wireless telegraphy.

Will.—Mr. HAROLD A. JACKSON, of Blackburn, dealer in electrical accessories, who died in July, left £8,084 gross, and £8,027 net personalty.

A REVIEW OF ELECTRICAL ENGINEERING PROGRESS.

Mr. E. W. Rice, Jun., president of the American I.E.E., delivered an address at the annual convention of the Institute on June 26th last, of which the following is an abstract from the *Journal*, Vol. 37, No. 8.

In the early days the progress of electrical science and arts was so rapid that it was relatively easy to find each year plenty of material for a review. Progress has continued, and will continue, but naturally a decided tendency to saturation is shown in many directions. In some instances, this saturation is due to the fact that limits of perfection have been so closely approached that little remains of possible accomplishment. In other instances the slowing up is due to lack of knowledge, or, especially at the present time, to lack of workers, such workers having been diverted to war work. The efficiency of conversion of mechanical into electrical energy, or the reverse, of electrical into mechanical energy, is still about 90 per cent. in the average case, under practical conditions of operation; the efficiency reaching as high as 97 per cent. or 98 per cent. in the most favourable cases, with the large units, and falling below 90 per cent. in unfavourable cases, or in the small units. The efficiency of conversion of electricity from high to low potential, as in transformers, also remains substantially the same, reaching as high as 98 plus per cent. in the largest units.. It is obvious that no material change can be expected where such practical perfection has been reached.

The conversion of the mechanical power of falling water into electrical energy by our water-wheels and electric generators has increased from about 87 per cent. to 90 per cent. in the largest units of 40,000 H.P. This represents about the limit which may be exepcted.

In the field of thermodynamic engines, represented largely by the steam turbo-generator unit, some improvement has been obtained. Rankine efficiency to the extent of 75 per cent. had been obtained in some large modern steam turbo units in 1915. This has now been increased to about 80 per cent. in the largest units of 35,000 to 40,000 KW. and 75 per cent. is quite common practice even in such moderate-sized units as 10,000 KW. This improvement, while not large, is doubly important because of the great increase in the cost of fuel. It has been realised mainly by bringing the practical design more nearly in accord with the theoretical, by increasing the number of stages or processes of steam extraction, reducing various losses, and by improving many details which, when properly looked after make in the aggregate, gains of practical importance.

Increase in the initial pressure of steam and lowering of terminal pressure, by better condenser arrangements, have also contributed to improvement, as it enables an increase in the range of temperature to be utilised. This makes possible better thermal efficiencies, even with the same per cent. of Rankine efficiencies.

The following table illustrates the improvement in efficiency of turbo-electric units from 1903 up to the close of 1917 :—

Year.	Size, KW.	Steam conditions.			Lbs. per KW.-hour.	Per cent. of Rankine efficiency.
		Steam pressure.	Superheat Fahrenheit.	Back pressure.		
1903	5,000	175 lb.	0°	2 in.	24·00	37·8
1908	14,000	200 lb.	125°	1½ „	13·50	66·1
1911	20,000	235 lb.	100°	1½ „	13·20	67·0
1913	20,000	200 lb.	200°	1 „	10·74	75·9
1916	20,000	250 lb.	250°	1 „	10·00	76·5
1917	35,000	230 lb.	200°	1 „	10·14	78·7

A percentage of Rankine efficiency of approximately 80 has been reached, which reflects great credit upon the designers of turbo-electric machines, and is a record of achievement found only in electrical development.

Concurrently with this improvement in the turbo-electric machines, great advances have been made in the design and operation of steam-producing devices—the boilers, and in auxiliaries and other features of the modern power station. As a result the thermal efficiency has been rapidly improved. This thermal efficiency may be stated as the ratio of the total energy produced at the terminals of the generator, to the total energy in the fuel burned—expressed as a percentage. It takes account of all losses from the coal under the boiler to the energy at the dynamo terminals. It is the ratio of the heat units equivalent to one KW.-hour, divided by the similar heat units in the fuel consumed to produce 1 KW.-hour at the generator terminals. This thermal efficiency is, after all, to the electrical engineer, the most important measure of progress. It measures the advance in station fuel economy, and as stated, many factors in addition to the improvement in turbo-generators have contributed to the result. Thermal efficiency may obviously be used to express the results of a single unit, consisting of turbo-generator, with its bank of boilers and other accessories, or it may be used to designate the combined result of all the units in a given power station.

The progress in the case of a combination unit, *i.e.*, turbo-generator, with its boilers, auxiliaries, &c., has been as follows :—

Year.	Size of unit KW.	Thermal efficiency, per cent.
1903	5,000	10·15
1908	14,000	15
1913	20,000	18
1917-18	35,000	21·6

For comparison, large gas engines in steel mill practice under best test conditions, show 25 per cent. thermal efficiency, but in actual operation, an efficiency higher than 18 to 20 per cent. is rare. Engines of the Diesel type, driving electric generators, realise 25 to 26 per cent. thermal efficiency when new, but are difficult to maintain at such efficiency.

The figures given must not be confused with the much higher thermal efficiencies often quoted for gas and oil engines, which refer to indicated horse-power and not to electrical output.

The steam turbo-electric unit has not reached its limit of thermal efficiency. Calculations show that, with pressures of the order of 500 lb. gauge, a thermal efficiency of 26 per cent. should be easily realised. While the efficiency of electrical units reached about its limit some years ago, progress has been made and is still possible in the generation, transmission, and utilisation of electrical energy. The struggle for improvement in efficiency has been transferred from the unit to the aggregate, called the system. Individual units of highest efficiency do not, of themselves, ensure that the system upon which they are used will be of the highest efficiency. To obtain the highest efficiency in practical operation, the element of time enters as a powerful factor. Our conception of efficiency should not be limited to a consideration of the relation between the instantaneous value of available heat units in coal and the electrical units produced at the point or points of consumption, but should consider the relation between the total number of heat units in fuel consumed in a given time, say 24 hours, to the total number of electrical units produced and used in the same time. The attempt to improve the efficiency of the system has shown the necessity for utilising the generator units and transmission and distributing systems, for the maximum possible time.

This has led to the study of such questions as load factors of generators, of stations, and of the system as a whole, to the study of the diversity factor, to the reduction of idle currents in alternating-current systems by the use of synchronous condensers, and to means for the reduction of the constant and no-load losses in all machinery, in transformers, &c. The resulting improvement has been effected, not only by changes in designs of the units themselves, but also by their method of use, based upon the recognition of the fact that the elimination or reduction of the losses at light load will greatly improve the total efficiency, especially when the time of use of the apparatus under load is a small part of the total time.

Automatic sub-stations for transformers and synchronous converters have come into existence; different power houses of the same system have been tied together electrically; transmission lines of different systems have been interconnected, so that the units may be usefully employed for the maximum period, or lie idle or unloaded for the minimum time. This general development has led to marked improvement in total energy efficiency, represented by the amount of fuel burned per electrical unit sold or utilised, and has also reduced cost of operation and charges for investment. There is still room for continued improvement in this direction, and the progress will be rapid, due to the pressure for maximum efficiency in the use of coal and of existing investment at the present time.

Many interesting examples of the methods and devices adopted to improve station and system economy and efficiency may be found. Large electrical systems have been arranged to be tied together electrically, for exchange of power. In Montana, eight hydro-electric plants successively use the same stream flow, the total effective head amounting to 600 ft., and not only is the natural flow of the stream thus successively utilised, but all the storage water is effectively used by each plant in series. In this same system, the yearly load factor is stated to reach 75 per cent. and the mean monthly load factor to reach 80 per cent. The interconnection of hydro-electric plants brings about another extremely important saving, based upon the variation of rainfall in amount and time on the different watersheds which are thereby brought to serve a common system. It frequently happens that there will be plenty of precipitation on one watershed, while another watershed may suffer from long continued drought. This condition varies not only in the same year but in different years. Interconnection serves to eliminate these variations by a process of averaging, and where the interconnected system covers a sufficiently wide area, a remarkable increase in total useful power is made available.

It has been estimated, and it seems a conservative estimate,

that through the saving in reserve equipment, improvement in load factor, and the diversity of different loads, the useful output of groups of large systems may through interconnection, be increased about 25 per cent.

Electric regeneration of power, that is the utilisation of the weight of trains running on a down grade due to the force of gravity to generate electricity which is fed back into the electric system to help other trains up grade, is an illustration of the same important improvement in the system efficiency.

It is desirable to call attention to the improvements obtained in system economy or efficiency because of the important savings in investment, in coal, in transportation, in labour and material, which in the aggregate, have already been realised. It illustrates the wonderful flexibility, value, and economy of a general system transmitting energy by electricity, compared with any other possible method.

The Standards Committee of the Institute has been of inestimable value to the profession and to the industry. The standards adopted have been flexible enough to ensure progress, and yet to discourage variations which were valueless. The standards have been cheerfully followed, and I am convinced that, as a result, the cost of electrical apparatus to the consumer has been greatly reduced over a number of years, and the quality has been improved. I consider that the money value of the work so done could be conservatively placed at many millions of dollars.

The relative growth of 60-cycle as compared with 25-cycle systems is reflected in steam turbine installations. In 1910 about 60 per cent. of the steam turbine-electric energy of the U.S. was supplied from 60-cycle units; in 1917 this had risen to approximately 75 per cent. This is an instance where standardisation is desirable and economical. It will hasten the time so often predicted, when a network of transmission lines, carrying electrical energy, will cover the country. These will be fed by super-power stations, suitably located with respect to cheap, reliable supplies of coal for fuel, and water for condensing purposes, and into the same network will also be fed energy from the various hydroelectric installations.

Marked advances have been made during the past year in the application of electricity to the electric furnace. It is estimated that the number of electric furnaces in the U.S. has been increased about 40 per cent. in the past year, and that there are now in operation over five times the number that existed five years ago. The world's output of steel from electric furnaces has now grown to approximately four million tons per annum.

Experience has demonstrated that electric furnaces can utilise the cheapest and most inferior raw material to produce steel of the most uniform and highest quality, with the greatest regularity. It is now possible to produce electric steel at substantially the same cost as that produced by the open-hearth method. This result has been brought about partly by the increased cost of the open-hearth method, but largely by a reduction in the cost of electric furnace operation. The marked change which has taken place in the reduction of the cost of operating electric furnaces is based upon greatly increasing the rate at which energy is delivered to the metal, both during the melting and the refining period. As a concrete example, I mention the history of a five-ton furnace. It was originally supplied with 800 K.V.A. at 80 volts. This was increased to 2,000 K.V.A. at 150 volts for the melting period, and about 1,400 K.V.A. at 100 volts for the refining period. The time for the heat was reduced from six to three hours, power consumption was reduced from 877 KW.-hours to 588 KW.-hours per ton, and the number of heats per 24 hours was increased from three to five, increasing the net output from 15 to 25 tons.

Electric resistance furnaces of large sizes, for special heat treatment requiring unusual exactness, are being extensively used, producing results greatly superior to oil or gas fire furnaces.

Electric welding, both by the arc and incandescent method, is being rapidly extended, and is destined to greater development in shipbuilding and similar operations.

Electrical engineers have been devoting much time to the solution of many war problems. It is not desirable or possible to review such work at present, but when the veil is lifted, we will all be gratified with the result.

In my address at the opening of the mid-winter convention of the Institute, in February, 1918,* I called attention to the advantages which it seemed to me would follow a more general electrification of the steam railroads of the country. I merely repeat at the present time that electric locomotives can meet in the most efficient and adequate manner the transportation problems confronting the country, and offer better results than are now obtained, or seem possible, with steam locomotives. There can be no question that railroad electrification is not only economical but imperatively needed to improve the present standards of steam operation. The electrified divisions of the steam roads have been free from troubles during the past severe winter, and I repeat that the coal famine which the country suffered last winter could have been largely avoided if the steam railroads had been electrified. Moreover, it should not be forgotten that steam locomotives burn about 25 per cent. of the entire coal mined in the U.S., and that 12 per cent. of the entire ton-mileage movement of freight and passengers carried over our railroad tracks is represented in cars and tenders required to haul coal to supply steam for the locomotives.

It is a truism that war requires the mobilisation of the nation's industries and their devotion to essential work. To operate these industries, it has been necessary to mobilise to the fullest extent available material and labour, which can only be converted into war work by the application of power. This power, in view of its great economy and flexibility, must be electrical. It is vitally important that the great electrical power-producing companies of this country should be helped in every way to meet the heavy demand which is placed upon them. It has been demonstrated that the quickest, most efficient, and altogether best way to meet the demand for power is through the expansion of such existing organisations and installations.

Fortunately, there is general appreciation of the fact, and comprehensive schemes are under consideration which will provide for the erection of large steam electric power stations in the mining regions. Favourable locations exist which are within reach by transmission lines of electric power stations now serving large industrial areas. By interconnection, present investment and machinery will be better utilised, and a large amount of additional electric power made available, without making any increased demand upon our congested railroad facilities.

I would say, in conclusion, that the saving in fuel, by such improvements as I have mentioned in various parts of my address, amounts to many millions of tons every year; the saving in material and investment represents millions of dollars, which manifestly represent service of the highest value to the industry and to the country. Such work is just as much the province of the electrical engineer as improvements in the design and efficiency of the electrical units, and requires the same scientific ability, vision and industry. I think that in no other field of engineering has there been such a remarkable improvement and a condition which so nearly approaches, in the matter of efficiency, to 100 per cent., as has been shown in the field of electricity. This phenomenal record is not the result of accident. It has been due to the enthusiastic devotion of the scientist and engineer and executives to their work.

*ELEC. REV., April 12th, 1918.

NEW COMPANIES REGISTERED.

Leeds Flint Glass Co., Ltd. (151,461).—Private company. Registered September 18th. Capital, £10,000 in £1 shares. To take over the business of electric lamp bulb and tubing manufacturers carried on by the Yorkshire Incandescent Electric Lamp Co., Ltd., at Belle Vue Glass Works, Old Mill Lane, Hunslet, Leeds, as the Leeds Flint Glass Co. Agreement with Yorkshire Incandescent Electric Lamp Co. The subscribers (each with one share) are:—H. F. Dowell, "Rosslyn," Knaresboro' Road, Harrogate, company director; W. Plews, "Woodlands," 51, Cardigan Lane, Leeds, merchant. The first directors are: H. F. McDowell and W. Plews. Registered office: Old Mill Lane, Hunslet, Leeds.

Yorkshire Battery Manufacturing Co., Ltd. (151,470).—Private company. Registered September 18th. Capital, £10,000 in £1 shares. To take over the business of electric battery manufacturers carried on by Yorkshire Battery & Manufacturing Co., Low Field Mills, Leeds. The subscribers (each with one share) are:—H. F. McDowell, "Rosslyn," Knaresboro' Road, Harrogate, company director; W. E. Farr, Central Bank Chambers, Leeds, solicitor. The first directors are: H. F. McDowell and W. Plews. Registered office: Low Field Mills, East Street, Leeds.

British Gauge Manufacturers' Assn., Ltd. (151,442).—Registered September 17th, limited by guarantee, with 100 members each liable for £5 in the event of winding up, to encourage, protect, and promote the British gauge manufacturing industry. The first members of the committee are:—W. C. Pitter, Upper Market Street, Woolwich, S.E.; W. J. Bassett-Lowke, Kingswell Street, Northampton; S. H. Jones, 84-6, Commercial Street, Newport, Mon.; S. A. Hartzsmann, James Street West, Bath; A. L. Pailthorpe, 115, Whitehorse Road, Croydon; P. A. Bartley, 140, Queen's Road, Clarendon Park, Leicester; L. H. Hounsfield (Trojain, Ltd.), Vicarage Road, Croydon. Registered office: 44, Caxton House, S.W.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wigan Electro-Metallurgical Works, Ltd.—First specific charge and loan agreement on freehold land and works at Wigan and the company's undertaking and property, present and future, including uncalled capital, dated September 2nd, 1918, to secure sums up to £7,500. Holder: Minister of Munitions.

Omega Lampworks, Ltd.—Particulars of £1,000 debentures, created July 6th, 1918, filed, the amount of the present issue being £400. Property charged: The company's property, present and future, including uncalled capital. No trustees.

CITY NOTES.

A Dutch Indian Supply Co.

The Algemeene Ned-Ind. Electriciteit Mij, which owns lighting stations in the Dutch East Indies, reports that notwithstanding the circumstances which hamper the normal course of business, the directors were satisfied with the development which took place in 1917. The monthly receipts for supply for lighting and power purposes increased month by month, and were greater by

£2,080 in December last than in the corresponding month in 1916. No large extensions were made in connection with the Soerabaja station in consequence of the great difficulties experienced in obtaining plant and materials; the mains were extended, but not to the extent desired, having regard to the constantly growing demand. In order to increase the reliability of the service it had been decided to lay a second high-pressure main to connect the power station at the Toentang with Semarang, and the materials had been ordered in, and were awaiting shipment from, the United States. It had also been resolved to order further Diesel engine sets, one of 600 H.P. for the Malang station, and one of 250 H.P. for the Pasoeroean station. The scheme for the connection of Salatiga and Ambarawa with the company's network had been modified owing to the circumstance that the concessions obtained for supplying Djoejakarta and Magelang had rendered necessary the preparation of a new project for dealing with various places in Central Java. The net profits amounted to £27,000, as compared with £22,000 in 1916, and a dividend at the rate of 7 per cent. has been declared on the ordinary shares, as against 8 per cent. in the previous year.

German Companies.

The directors of the *Isaria Zähler Werke, of Munich*, recommend a dividend of 15 per cent. for 1917-18, this comparing with 12 per cent. in the previous year.

The accounts of the *Deutsche Elektrizitats Werke, Garbe Lahmeyer & Co., of Aix-le-Chapelle*, permit of the payment of a dividend of 6 per cent. for 1917-18, being the same rate as in the preceding year.

The *Internationale Stickstoff A.G., of Wiesbaden*, whose works are leased to the Elektro-Chemische Industrie, of Cologne, reports a loss of £48,000 for 1917-18. It is proposed to extinguish the deficit by writing down the share capital to £48,000.

The report of *Brown, Boveri & Co. A.G., of Mannheim*, states that all departments were actively occupied in 1917-18, and the working expenses again increased. Concerning the company's investments, it is mentioned that the Turbinia Co. again yielded 20 per cent., the Castings Works of Frankenthal 8 per cent., and the Howaldt Shipbuilding Works of Kiel 8 per cent., whereas no distribution was made in 1917 by the Electric Power Supply Co. of Mannheim. After setting aside £62,000 for depreciation, as against £44,000 in 1916-17, the accounts show net profits of £89,000, as compared with £73,000, and a dividend of 15 per cent. is proposed on the ordinary share capital of £450,000, this contrasting with 12 per cent., 10 per cent., and 5 per cent. in the three preceding years respectively.

Russia.

The Petrograd (1886) *Lighting Co.*—The undertaking of the Electric Lighting Co. of 1886 was declared to be State property at the end of 1917, notwithstanding protests made in various quarters, and the works, both in Petrograd and Moscow, are being continued for the account of the State. The managers and other officials remain, and the works are said not to have been damaged, although nothing is known of the condition of the Lodz works. According to information received in Switzerland, the supply of energy from the Petrograd and Moscow works declined from 208,000,000 KW.-hours in 1916 to 254,000,000 KW.-hours in 1917; and the accounts for last year closed with a loss of £54,000, as compared with net profits of £869,000 in 1916. The expenses in 1917 included interest at the rate of 5 per cent. for the years 1914, 1915, and 1916, so that the total amount placed to the credit of the shareholders in dividends and interest was £1,236,000 at the end of last year.

To be Struck off the Register.—Unless cause is shown to the contrary within three months the following companies will be struck off the register:—

Dickson Corthesy Steam Turbine Developments, Ltd.
Harvey Electro-Chemical Co., Ltd.
High-Speed Printing Telegraph Co., Ltd.
Kentish Town Motor & Electrical Engineering Co., Ltd.
Mid-Sussex Electric Light & Power Co., Ltd.
North-Eastern Electric Smelting Co., Ltd.
Radium Electro-Emanation Co., Ltd.
Telephone Accessories Co., Ltd.

Norwegian Companies.—The Norske A.S. for Elektrokemisk Industrie has decided to increase its share capital from £791,000 to £1,592,000, so as to provide for future development of the company's water powers and mines. Two subsidiary companies—the Elektrokemisk Atlas of Christiania, and the Vestlandske Elektrokemisk Atlas of Bergen—are also raising their share capital, and a new concern has been formed under the title of the Elektrokemisk Oversoiske Handels Compani, which is to constitute the basis of existing and proposed sale companies.

Yates & Thom, Ltd.—Year ended August, 1917. Net profit, after providing for depreciation, debenture interest, and writing down investments to market value, £56,172, plus £25,573 brought forward. Dividend 10 per cent., less tax. £67,796 carried forward, subject to excess profits duty.

Southern Brazil Electric Co., Ltd.—For 1917 the profit was £4,838. This, together with £4,271 brought forward, is to be carried forward.

Direct Spanish Telegraph Co., Ltd.—Dividend of 10 per cent. per annum on the preference shares, and an interim dividend at the rate of 4 per cent. per annum, free of income tax on the ordinary shares, both for the half-year ended June 30th.

Bombay Electric Supply & Tramway Co., Ltd.—Interim dividend on the ordinary shares at the rate of 14 per cent. per annum for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business had been moving on fairly favourable lines until to-day, Tuesday, when the railway trouble took an unexpectedly acute turn, and had a pronounced effect upon every market in the Stock Exchange. In departments where anything like a bull account has been built up, the effect was particularly noticeable, because people hurried to take their profits and to stand from under while the position looked threatening. The extension of the strike to lines other than those immediately concerned would probably involve many of the industrial companies, the shares of which have lately been so popular, and therefore the speculative investor elected to get out where he could at a profit. The influence extended to Consols and investment markets, and home rails were, of course, especially flat.

Last week's so-called settlement of Labour disputes on the railways had the effect of making some of the stocks a little better, but the recovery did not go far, and it was very quickly lost on the unexpected outbreak of the Welsh and Great Western railwaymen. Amongst the Undergrounds, Metropolitans have fallen back to 25½, and Districts to 25, but the assented ordinary stock of the Central London has gained 2 points at 62½. Underground £10 shares have lost 2s. 6d., and the "A" shares are 1s. lower. At the same time, it is worth noticing that there is no falling off in the demand for pre-ordinary railway stocks, the majority of which show comparatively small returns, ranging from 5 to 6 per cent. on the money.

One of the most active markets for the week is that for Marconis. In the parent shares each successive wave of buying has encountered a fair volume of sales, but, in spite of the latter, the price has risen to 4¼, and, of course, is talked better (the "of course," incidentally, applies generally to any shares with a rising market, since nobody foresees a reaction so long as prices are going up). Considerable animation prevails also amongst the subsidiaries, of which the most prominent during the past day or two has been the American Marconi. The price of the shares is now 32s. 6d., while Marconi Marines further advanced to 67s. The Canadians lag a little behind the rest of the group, remaining about 14s. 6d.

Victoria Falls ordinary shares have thrown off some of their recent stagnation, and are quoted better at 20s.; the preference keep steady at 23s. 9d. If the South African mines are to obtain the expected relief in the shape of what will amount to subsidies to gold-producing companies, this will give a fillip to the industry, and reinvigorate mining as a whole, with consequences that should prove favourable to the Victoria Falls undertaking. Thus, at all events, runs the argument of those who are buying the shares now. Other Colonials which have improved include several of the Canadian power companies engaged in making munitions, and whereas these for some time past have been under a cloud, they are now beginning to develop strength and enhanced prices. The buying of American electric power shares is checked by the uncertainty that prevails with regard to the manner in which the new excess profits duty in the United States will work out, and its effect upon balance sheets, although, as a Stock Exchange factor, the experience of the London market is that excess profits duty carries little weight when the public are bent upon buying shares in companies affected by it.

Brazilian Tractions have taken a turn for the better, and are up to 49. The Anglo-Argentine group is also harder, the first preference shares and 5 per cent. debenture stock improving. British Columbia Electric Deferred put on ¼ on the assumption that the recent heavy fall was a little overdone, and that with the prosperous conditions now prevailing in Vancouver this company should be able to take full advantage of the increased trade that is doing. Amongst Mexicans, there is nothing much going on. If anything, sentiment is not quite so good as it has been lately, but attention is turned to other things at the moment, and therefore prices tend to droop, though Mexican Light & Power preferred is 2 up.

London electric lighting shares are steady. Westminster ordinary and County preference are both ¼ harder. It is claimed in the market that holders are mostly investors who, having retained their shares during the bad times through which the lighting industry has passed, are prepared to hang on until the end of the war, undeterred by lighting restric-

tions, coal shortage, or anything else. As before noted, it is thought quite likely that there may be reductions in dividends in respect of the current half-year. Gas stocks are equally steady. Amongst the electrical manufacturing shares business ruhs quietly. British Aluminiums have picked up after their slight decline on the dividend disappointment, and are now 38s. 9d. again. Ediswans are a little dull at 15s. 9d., while Cromptons and other manufacturing shares of similar kind are holding their prices. General Electric preference gained ¼. The telegraph manufacturing list is equally steady. Western Telegraphs have strengthened. Anglo-American preferred rose 1. The time has been extended for presentation of the fifths in the Oriental Telephone Co. The price is 12s. to 12s. 6d. per fifth.

Something of a sensation was caused by a violent rise in Vickers upon the reiterated statement that when the accounts are at length published the figures disclosed will be startling. Vickers have been singled out for particular attention, other armament shares being overlooked in the activity that has centred round the favourite for the moment. The rubber market derived a little assistance from the decision of the Straits Settlements Government to support the industry by making loans against the raw produce, and by other expedients, though this has not done much towards reviving business. A boomlet occurred in the shares of the British Platinum Co., the prospectus of which appeared in the summer time, when the £1 shares were offered at a premium of 2s. 6d. per share. No great rush occurred at the time, but within the past week the price has doubled in value, and the shares, now 10s. paid, were run up to 23s. 9d. before reacting to 18s. 9d. Amongst tin and copper shares, nothing worthy of note has occurred.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price Sept. 24, 1918.	Rise or fall.	Yield p.c.
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3⅜	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3⅛	—	7 16 10
City of London	8	8	11½	—	7 2 3
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 3 1
County of London	7	7	9¾	—	7 1 9
do. do. 6 per cent. Pref.	6	6	9⅞	+ ⅛	6 3 1
Kensington Ordinary	6	7	5¾	—	6 17 7
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅛	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6¾	—	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6¾	+ ⅛	7 7 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	6	6	92½	+1	6 2 0
do. Def.	1½	1½	23½	—	6 7 8
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	125⅝	+ ⅛	*5 2 5
Eastern Tel. Ord.	8	8	168½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	141½	+ ½	*4 16 5
do. do. Pref.	6	6	105½	—	5 17 1
Great Northern Tel.	24	22	86	—	5 15 9
Indo-European	13	—	67½	—	5 12 6
Marconi	15	20	4⅝	+ ⅛	4 4 3
Oriental Telephone Ord.	10	10	24¾	—	8 4 0
United R. Plate Tel.	8	8	73	—	*5 3 3
West India and Panama	6d.	1/3	1½	—	*3 6 8
Western Telegraph	8	8	168½	+ ½	*4 16 3

Home Rails.

Central London Ord. Assented	4	4	62½	+2	6 8 0
Metropolitan	—	1	25½	— ½	3 18 5
do. District	Nil	Nil	26	— ½	Nil
Underground Electric Ordinary	Nil	Nil	9⅜	—	Nil
do. do. "A"	Nil	Nil	7/-	—1/-	Nil
do. do. Income	6	4	83½	—	*4 16 3

Foreign Trams, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	+ ⅛	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅛	+ ⅛	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	68	+1	7 7 3
Brazil Tractions	—	—	49	+2	—
Bombay Electric Pref.	6	6	102	—	5 11 7
British Columbia Elec. Ry. Pfce.	5	5	68½	—	8 11 0
do. do. Preferred	Nil	Nil	41½	—	Nil
do. do. Deferred	Nil	Nil	32⅝	+ ⅛	Nil
do. do. Deb.	4½	4½	57½	—	7 7 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	49	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	28	—	Nil
do. Pref.	Nil	Nil	42	+2	Nil
do. 1st Bonds	Nil	Nil	61	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	3⅛	— ⅛	3 18 9
British Aluminium Ord.	10	10	1⅛	— 1/32	5 3 0
British Insulated Ord.	20	20	9⅛	—	4 6 6
British Westinghouse Pref.	7½	7½	9⅞	—	5 9 1
Callenders	20	25	10½	— ½	5 19 1
do. 5 Pref.	5	5	4½	—	5 11 1
Castner-Kellner	22	20	3⅝	—	5 10 4
Edison-Swan, "A"	—	—	1/32	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10½	+ ⅛	6 3 10
do. Ord.	10	10	18½	—	*5 8 1
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 9
Telegraph Con.	20	20	47½	—	*5 1 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 25th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	"	£77	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	..
a Copper Sulphate	"	£64	..
a Potash, Chlorate	per lb.	2/4	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£38	..
a " Lump	"	£18	£3 inc.
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/9	
g " Bars (best selected)	per ton	£161	..
g " Sheet	"	£161	..
g " Rod	"	£161	..
d " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£161	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/8½	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/4	4d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
i " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 8d.	..
e " " " medium	"	3/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Electric Vehicle Progress.—It is interesting to note that according to the *Light Car and Cycle-Car* great strides have been made in Switzerland in the use of electric vehicles, and not only are big three-ton lorries for use in road construction and watering carts for use in town seen frequently, but also mail cars, omnibuses for hotels, and private cars for doctors and others. This speaks well for the "electric" when it is remembered that Switzerland is not by any means a flat country. An interesting point in connection with the charging of batteries is mentioned; the method entails the minimum amount of trouble. A contact is arranged in the garage, and, before leaving the car for the night, the driver merely pushes in the plug connection and the current does the rest. When the car battery is fully charged the current is automatically cut off. The use of "electrics" in Switzerland for invalids is not overlooked, and, as a result, a very neat and comfortable electrically-propelled bath chair has been produced.

The Electrical Poultry Farm.—An ingenious New Hampshire poultryman feeds his 1,500 hens with one-tenth the labour this work entails on other commercial poultry farms of similar size, says the *Scientific American*. This result is accomplished with six electric feed distributors, each of which has a capacity of 22 bushels of mixed grain. An electric time clock is set to operate the feeder five times a day, at which times grain is scattered automatically over 4,526 sq. ft. of floor space. The grain hoppers hang within 1 ft. of the floor; the time clock sets in operation an electric motor, mounted on a short vertical shaft, and opens the outlet. As the grain drops a revolving paddle scatters it around. Other devices used on the farm include electrically driven food and grain mixers, and an electric fence which was erected to prevent thieves, foxes, &c., stealing the poultry. The fence is double, the inner one being of ordinary chicken wire to protect the chickens from the outer wires, which are kept charged at 220 volts. Signs posted at frequent intervals announce the fact. The fence is set 4 ft. within the boundaries of the property. Thus the owner is within his legal rights, as any person coming in contact with the fence has already trespassed. It is stated that the fence has many times justified its cost.

THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).

Annual Conference at Leicester.

YESTERDAY the 17th annual Conference of the Municipal Tramways Association was to be opened at the Town Hall, Leicester. After a reception had been held by the Mayor (Alderman North, J.P.) and the Tramway Committee, the presidential address was to be delivered by Alderman S. Flint, J.P., chairman of the Corporation Tramways Committee, Leicester. Welcoming the members to Leicester, the president remarked that this was the first time the annual conference had been held there, and gave some interesting particulars regarding the history of the town, which for over 1,000 years enjoyed the distinction of being called a city. He emphasised the enormous amount of work that had been done by the Executive Council during the past year, and the burden placed upon the secretaries—first Mr. Fearnley, then Mr. Spencer, the present secretary. Mr. Hamilton and Mr. McElroy had also rendered signal service to the Association during the year.

Referring to the more important matters that had arisen since the last Conference, Ald. Flint mentioned the questions of Coal Conservation and Electric Power Supply, and of the creation of Joint Industrial Councils as suggested in the Whitley Report. On the last-named subject they had had several conferences with the men's representatives, and the outlines of a scheme would be submitted to the members for consideration at an early date.

The continued advances in wages and materials had placed heavy burdens on many undertakings, necessitating further increases in fares. The Association had conferred with the Tramway and Light Railway Association on this matter, and with the Board of Trade, with the result that Parliament had given authority to the Board to raise the statutory limits, under certain conditions.

An application for a further increase of bonus of 12½ per cent. was put in by the National Transport Workers' Federation on behalf of the Amalgamated Association of Tramway and Vehicle Workers. The claim was submitted to the Committee on Production, and after a long hearing, during which the case was put forward elaborately for both sides, the men were awarded 5s. per week increase of bonus, whilst the claim on behalf of the women was dismissed. To their surprise, an appeal was made against the award as regarded the women, and although this part of the case was fully argued and considered before the award was given, the Committee on Production, after further consideration, granted the 5s. extra bonus to the women, thus reversing its former decision, in spite of the fact that it was clearly proved that it cost much more to run the cars by women than by men. This raised a very serious question. If one side to an arbitration were allowed to appeal against an award, then the other side might claim the same right, and that might lead to serious results.

Another matter of considerable interest was the appointment of the Tramways (Board of Trade) Committee.

All the indications were that they would have to carry on under greater difficulties than any they had yet had to face, while most of them had private difficulties and sorrows to meet. Meanwhile, let them do all they could, individually and collectively, to assist the Government in carrying on the war to a successful issue.

The next item on the agenda was a paper by Mr. Ernest Hatton, engineer and general manager of the Newcastle Tramways, of which an abstract follows.

The Post-War Position of Electric Power Supply.

BY ERNEST HATTON.

(Abstract of paper to be read before the MUNICIPAL TRAMWAYS ASSOCIATION *at Leicester, September 26th.)*

INVESTIGATIONS into our past efforts have produced two reports on electric power production, which, whilst condemning us for our apathy, contain many valuable suggestions.

Electric power and most other commodities can be produced very cheaply in large quantities with proper facilities in most large commercial centres in this country, but it is the economical distribution of such commodities which ultimately determines the price of any article. The cost of electricity as between producer and user is therefore largely influenced by the charges on capital outlay in bringing the product or supply to the user.

The reports above mentioned insinuate that we have only in the past been dealing with the subject in a playful mood, and that if we do not now alter our methods we shall be hopelessly left behind by other nations. Criticism, however, on our past conduct does not get rid of our annual charges on existing undertakings, and these charges, coupled with the new annual charges on capital account on the proposals in these reports, will ultimately be the measure of our future success and charges for electric power, reduced of course in proportion by the influence that increased output will have if these schemes are developed. At present this is an unknown quantity, but must subsequently be very great. Even then, however, we must bear in mind that wages and everything which counts in the production of electric power will for many years be a determining factor upon cheap power supply, so that in some cases it may, even under the most favourable circumstances, be some time before we again get inclusive prices per unit which will compare with the charges made in 1914; but in the years to come, if the schemes or some modification of them as outlined in the reports are adopted, it must ultimately lead to a general reduction in charges, to the great benefit of the country.

Any scheme of general power supply if it is to be a success must within a reasonable period, by its more economincl working and production on a large scale, be able to carry on its back the annual charges upon the plant which will be superseded or closed down by its adoption, and it seems to me that much of the plant which will be superseded in some areas under the proposed schemes could well be transferred to areas with lesser immediate demands, and be in the meantime used with advantage, or suitably disposed of, leading to great capital saving and consequently lower annual charges upon the accounts. The subject therefore in the first instance requires an impartial survey of the proposed areas, the plant requirements for the area and the best use some of the existing plant (which must make way for plant of greater capacity) can be put to in order that the new capital charges can be kept within reasonable limits. Where demands are heavy, of course, the existing plant will have to be kept in commission until the larger and more efficient plant decided upon for the several areas can be brought into operation, and therefore these matters should be decided without delay; a programme for each area could then be settled, and with a clearing house for making the best use of existing plant superseded under these schemes, the greatest economy in capital expenditure would be obtained.

If the authorities decide upon the electrification of the railways, the whole policy of the country with regard to electric supply will require to be treated from a wider standpoint altogether. The existing plant, whilst no doubt suitable for ordinary commercial purposes, would not, either in capacity or general location in many cases, be suitable for the larger purposes under review.

Take the case of an isolated town with its own power station working economically according to its present demands, located on the main line of any of our principal railways; should that main line subsequently be electrified, then rarely would it be advantageous to extend the small local power station to meet the larger demands unless it was most favourably situated in regard to the essentials for cheap power production on a large scale. Generally the most advantageous way of dealing with such a case would be to shut down this small local station as a generating centre and to make it a sub-station of the greater electric supply to the railway system passing through the town. It is therefore vital, to deal with this subject in its broadest and truest sense, that some declaration should be made by the authorities at the earliest possible moment.

If the railways are electrified, they will bring power supplies into almost every area in this country, since it is so well served by railways. Some areas will be able to produce power at lower costs than other areas not possessing the same advantages, and a question which should receive the closest attention of the authorities is whether standard rates and charges should eventually be set up. In the event of differential rates, the tendency will be in the future for intense development in some areas, as undertakings will gravitate to those areas supplying power at the cheapest rates, whereas I am of opinion that general development all over the country should be encouraged instead of intensive development in some areas. This would ultimately give the greatest benefit to the population, especially with regard to housing, &c., and food supplies.

Some areas will have the advantage of waste heat from certain manufactures and processess, and where possible the erection of works having a surplus of waste heat, which could advantageously be used in the generation of power, should be encouraged in areas not now enjoying these advantages. This is a matter that may require the parental control of the Government of the day.

I am of the opinion, having in mind the existing electric power developments of the North-East Coast, that an area embracing the North Riding of Yorkshire and the counties of

Northumberland and Durham should be chosen, in the first instance, for a practical demonstration of the policy of general power supply operating over a large area under one authority, and the experience gained thereby would be of the greatest benefit to other areas of the country. The constitution of the power boards set up in the areas should in every case have a majority control of public representatives elected by the area, together with the representatives of large consumers.

All generating stations in the area, together with the main transmission system of the area, including the power supply to railways and all public bodies, should be under control of the board, but those localities or towns where preference is in favour of local distribution should, in the first instance, be allowed to act in that capacity only; but in any case the power generation and supply mains must for obvious reasons, be under the complete control of the power board.

(To be continued.)

AN ELECTRIC AMBULANCE.

Everyone has noticed the innumerable examples of vehicles of all conditions and sizes utilised in pre-war days of normal transport for trade purposes, which have during the last four years been turned to account to do duty with auxiliary hospitals or volunteer forces as emergency ambulances. The majority of such vehicles have been converted by the mere substitution of internal fittings embodied for trade purposes by stretchers and supports for them. This sort of improvision might answer the purpose if only slightly wounded men were to be carried, but for those more severely wounded it would leave much to be desired, unless the converted vehicle was a particularly smooth-running machine. Some makes of vehicles are naturally more adaptable to conversion for this class of duty than others, and it would seem to us that in this respect the electric vehicle would approach more nearly to the ideal than any other type. There we have a class of machine which possesses certain qualifications for ambulance work. It is simple to start, and is smooth-running in operation, not being subject to jerky gear-changing, as is its petrol consort.

Messrs. R. Walker & Sons, Ltd., the makers of Wolsey clothing, of Leicester, soon after the outbreak of hostilities converted a 2-ton Edison van for duty as an emergency ambulance. A solid-tired 2-tonner might be considered somewhat cumbrous for this delicate class of duty, the smooth-running of the vehicle, however, amply compensates this possible disadvantage. It strikes us as being a commendable emergency conversion.

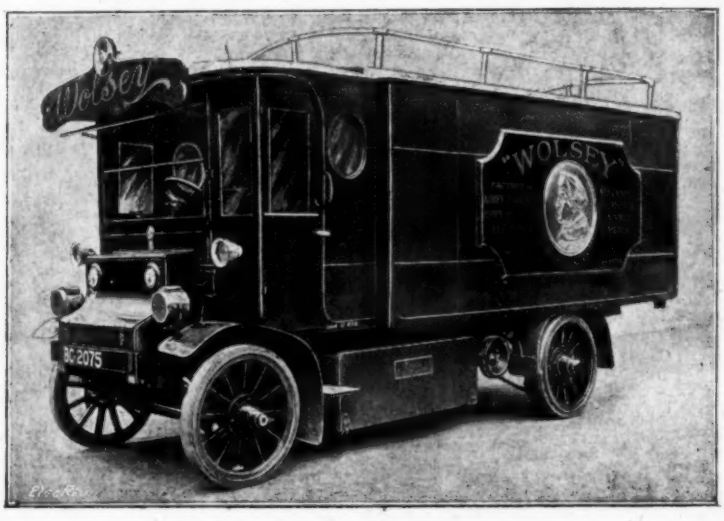

Fig. 1.—A 2-ton Edison Electric Emergency Ambulance.

The chassis of the vehicle referred to (fig. 1) is a 2-ton Edison electric Detroit model, fitted with a 5-h.p. motor with controller and Edison battery. A large covered body is fitted, being 12 ft. long inside, 6 ft. 9 in. wide at the top, and cambering to 6 ft. 6 in. wide at the bottom, while the roof is 5 ft. 3 in. high at the sides, and 5 ft. 8 in. in the centre. It is built of wood framing, with 3-ply wood for panels, and stained and varnished a medium oak colour, with red wheels, black wings, and white roof and rails. The cab of the vehicle is entirely covered in with hinged glass screens, there being a glass door at the near side, and a lowering glass light at the driver's side, enabling him to give the necessary direction signals when on the road.

Two large bronze plates are fitted, one on each side of the van, with a "Wolsey" head embossed thereon. The van has been in regular daily use since November, 1914, for the carrying of Wolsey underwear and other goods between the firm's various factories in Leicester, steam wagons being utilised for the carriage of goods between the country factories and Leicester. During the period of the war the firm has been almost exclusively occupied in the manufacture of hosiery goods for Army and Navy purposes, the van being consequently utilised for this purpose.

Since 1915 the local V.A.D. has made very considerable use of the van for ambulance purposes, for the carriage of wounded between the hospital trains and the local hospitals, calling on it for this purpose whenever the trains arrive. To meet this emergency the hinged doors of the van are made to lift off, so that a loose curtain on a rod may be installed. Inside the van skids are provided which can be quickly attached, enabling the stretchers to slide thereon. Eight stretcher cases are carried at once, there being four on each side arranged bunkwise, or four on the floor and four suspended from the roof, end on, leaving an alley-way down the centre for the orderlies.

The van is admirably suited for this class of work, not only owing to the number of stretcher cases which it carries at one time, but also due to its smooth running and freedom from violent acceleration, enabling the worst cases to be carried with comfort.

The owners assure us that they feel justified in saying that the van has done good service, and has proved very reliable.

THE METRIC SYSTEM.

The British Science Guild has invited the special attention of the Minister of Reconstruction to the importance of making every possible effort to encourage the introduction into the United Kingdom of the metric system of weights and measures, in connection with his endeavours to preserve and develop the trade and industries of the Empire. The subject has long engaged the attention of the Guild as a matter of vital importance to commercial and industrial prosperity. The Guild appointed a committee to consider the subject, and received a report, framed with a view to immediate preliminary action on the assumption that the expediency of the adoption of the system is generally recognised, and dealing mainly with the practicable methods for bringing it about.

The first step is to make it clear that the table of equivalents in the Schedule to the Order in Council of May 19th, 1898, may be adopted for all practical purposes, and the metre as therein defined taken as the standard. In schools and educational institutions attention should at once be more seriously directed to the use of the decimal system of calculating in simple units of length, weight, and currency.

The Guild considers it all-important that learners should not be allowed to look upon decimalisation and the metric system as an "extra" subject; a definite pronouncement, emanating from the Ministry of Reconstruction, to the effect that the prospects of the coming generation in all business careers will depend upon a thorough knowledge of the subject, may be of great value, and it should be clearly announced that it will be tested in all examinations for Government employment.

In actual trade and manufacture Government influence may be brought to bear with the aim of making the use of the metric system the practice before any attempts are made to enforce it by compulsion. If it were generally known that it would be made compulsory in, say, five years, there is every reason to believe that it would be voluntarily adopted within that time. In the meantime, Government Departments could take such steps to make it more convenient for the commercial and industrial community to accept and accelerate the change rather than to resist it. In this connection the report points to:—

(*a*) The adoption of metric standards in Government publications inviting tenders, &c., without giving equivalents in British standards, except such general indications as may be thought absolutely necessary as a guide. British merchants and manufacturers engaged in export trade have long had to accommodate themselves to dealing with such publications in conducting a large part of their business.

(*b*) The especial power of the Government at the present time to insist on the use of the metric system by the railway companies whenever required by the consignors. The refusal by these companies to accept consignment notes made out in the metric system has been one of the great obstacles in the way of manufacturers who have tried to use the system.

Comparative tables should be prepared and distributed free of cost, or at a nominal price.

With a view to making an easy beginning in the process of displacing existing habits, it is suggested that an immediate start should be made with the currency, which involves only the decimalisation of an existing standard. For the same reasons the tables first circulated for practical use should be made as simple as possible.

The report of the Committee states that the metric system should not be regarded merely as an interesting alternative system for educational purposes, with a view to occasional practical application hereafter. Rather should it be taught as a fundamental system, and the standards now in use, with their multiples and sub-divisions, regarded as obsolescent variants which for practical purposes it is necessary to understand and apply under existing circumstances.

In actual business practice an abandonment of superfluous denominations occurring in the existing standards would be temporarily useful as a preliminary step. In America and in some of our Colonies the weights of railway wagons are expressed in lb., instead of using four columns for tons, cwt., qr., lb. Simplification of existing British practice by absolute abolition of such superfluity would be a good preparation for the eventual substitution of the single decimalised metric unit for the diverse units now employed.

The experience of the well-known firm of Kynoch & Co., Ltd., is cited in a letter dated February 2nd, 1917, from the chairman of that company, as follows:—

"We tried very hard to introduce the metric system into these works, but we had to give it up in most of our departments. We could get nobody to invoice to us in that system, and therefore everything had to be translated, which more than made up for the saving that the internal use undoubtedly achieved.

"An an instance of our difficulties, the railway companies refused to accept goods, consignment notes for which were made out in the metric system.

"The people who used it appreciated it very much, and we have retained it still in those shops that have no communication with the outside world.

"We consider that the universal adoption of the system would be an immense advantage and economy for this country, and we would suggest that the use of both systems should be legalised for some four or five years, after which the metric should be compulsory.

"If everybody knew it had to come, I think the change would, for the most part, be made within two or three years."

The adoption of the system in Government announcements, contracts, and communications, beginning with easily practicable cases, could be extended with increasing familiarity, and ultimately supplemented by an absolute refusal to receive tenders, invoices, and other communications expressed in any other system. Such a course would lead the way to legislation following the same lines, but not abruptly prohibiting old business habits. If contracts were made unenforceable in the Law Courts except in the terms of the metric system, and the expense of officially certified conversion into that system of the terms used in the contract were put upon the litigant party seeking relief, it would go a long way towards compelling universal adoption. At the same time it would not make people immediately liable to penalties, or render their dealings absolutely nugatory if they chose, at their own risk and for the present, to express their contracts in weights and measure more familiar to them. It would facilitate the introduction of compulsion within a reasonable time.

The decimalisation of the monetary unit would plainly bring advantages similar to those resulting from the decimal sub-division of the metre. The Committee, in conclusion, calls attention to the following publications of considerable importance:—

(*a*) A paper on "Great Britain's Interest in the Metric System of Weights and Measures," reprinted from the Electrical Review of March, 1918, and published by the Decimal Association.

(*b*) An article published in the Electrical Review of March, 1917, dealing (amongst other things) with the unfounded apprehension of merchants and manufacturers with regard to changes of machinery, tools, designs, patterns, &c., which they imagine to be involved in the adoption of the metric system, and with regard to the preparation and use of comparative tables.

(*c*) "Recueil de Coefficients pour la Conversion des Poids, Mesures, et Monnaies au Système Métrique, Decimal." Third edition, 1914. (Published in Rome by the Imprimerie de l'Instut International d'Agriculture.)

Cable Insulation.—It has been shown that cables insulated with mineral-base compounds have greatly reduced dielectric losses, compared with those insulated with vegetable-base compounds, says the *Engineer*. It has been further shown that cable ratings under some conditions were more than doubled, and, on the average, could be increased 20 or 30 per cent. when the mineral-base insulating compounds were used. A start has been made in America in the matter of preparing specifications covering dielectric losses in cables. Engineers of some of the principal cable manufacturers have agreed to co-operate.

THE UTILISATION OF WASTE HEAT FROM OPEN-HEARTH FURNACES.

By THOMAS B. MACKENZIE, M.I.Mech.E. (Motherwell).

(*Abstract of paper read before the* Iron and Steel Institute, *September*, 1918.)

In this paper the author gives particulars of experiments on the generation of steam by the waste heat from open-hearth furnaces. The first attempt was made 20 years ago with boilers of the Cornish type; the waste gas from the furnace was divided into three streams, each of which travelled once along the length of the boiler, reuniting again at the chimney end. Owing to the cooling effect on the gases, the draught of the furnaces was reduced to such an extent that their operation was slowed down sufficiently to compel this attempt to recover the waste heat to be abandoned. It occurred to the author that the placing of an induced draught fan beyond the boiler would be a solution, and an experimental boiler, economiser, and fan, on the lines he advocated, were attached to one of the smaller furnaces in the works.

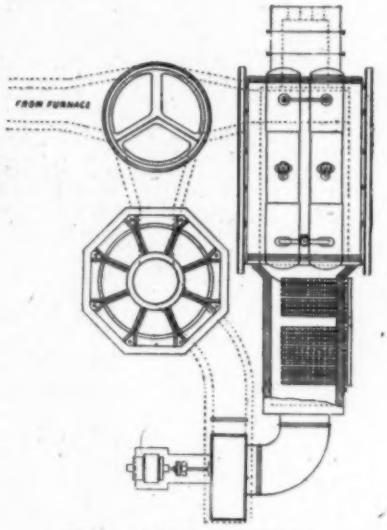

Fig. 1.—Lay-out of Plant.

The furnace was an acid-lined open-hearth furnace of 30 tons nominal capacity. The boiler was of the Babcock & Wilcox water-tube type, having a heating surface of 1,619 sq. ft. In series with the boiler was placed a Green economiser, having a heating surface of 720 sq. ft. The fan was of the Keith & Blackman type, having an impeller 20 in. in diameter driven by a variable-speed direct-current motor of 20 B.H.P. After some minor troubles had been overcome, the installation was got to work satisfactorily, and a test was made extending over a period of 111 hours, in order that a fair average from all conditions of the furnace would be arrived at.

The mean values of the observed data are as follows:—

Temperature of "products" entering boiler ...	504° C.
Temperature of "products" leaving boiler and entering economiser	254° C.
Temperature of "products" leaving economiser and entering fan	169° C.
Temperature of cold feed entering economiser ...	11·6° C.
Temperature of hot feed leaving economiser and entering boiler	117·8° C.
Steam pressure per sq. in. (gauge)	86·5 lb.
Weight of water evaporated per hour, actual ...	2,440 lb.
Weight of water evaporated per hour, "from and at"	2,800 "
Weight of water evaporated "from and at" per sq. ft. of boiler-heating surface	1·73 lb.
Natural draught of chimney with boiler, &c., dampered off	0·6-in. W.G.
Draught at base of chimney with boiler, &c., on fan running	0·8 " "
Probable volume of "products" at s.t.p. passing through boiler, economizer, and fan per hour	380,000 ft.³

Efficiencies.—Boiler, 35·55 per cent.; economiser, 14·48 per cent.; over-all, 37·80 per cent.

The fan absorbed 14·3 Board of Trade units of electricity per hour. The amount of steam generated was 1,084 lb. per ton of ingots.

If the steam generated per hour had been used in a modern turbine with a good vacuum to generate electrical energy, the amount generated would have been:—

		158·0 B.T. units.
Deduct amount used by fan	...	14·3 " "
Leaving a net amount of energy available for outside work of...		143·7 " "

Assuming boiler fuel to have a calorific value of 6,700 lb.-calories

per lb., and that ordinary steelworks boilers have an efficiency of 65 per cent., the fuel equivalent of the steam generated was 357 lb. per hour, equal to 158·7 per ton of ingots.

If we divide the net amount of electric energy available for outside work by the rate of production of ingots, we obtain 63·86 Board of Trade units per ton, an amount which should be sufficient to roll the steel produced by the furnace.

These results having demonstrated that the author's arrangement was quite practicable, and did not in any way interfere with the furnace output, it was decided to provide a new smelting-shop in process of erection, and containing open-hearth furnaces of 45 tons nominal capacity, with similar equipment.

The equipment consists, for each furnace, of a Babcock & Wilcox water-tube boiler, having a heating surface of 1,827 sq. ft.; a Green economiser having a heating surface of 960 sq. ft., and a Keith and Blackman fan with an impeller 30 in. in diameter, driven by a variable-speed direct-current motor of 40 B.H.P.

This plant was finished and put to work shortly before the war broke out, so that no tests were made of its performance. Since the war the author has been jointly responsible for adding seven boilers and fans to old furnaces and ten to new furnaces, and it is unfortunate that the theory was not developed, as, had it been done, larger boilers would have been used and more steam obtained.

The results of numerous other tests are given in the paper in great detail, and are fully discussed by the author.

None of the boilers above referred to were provided with superheaters, but there is no doubt that such could be quite well applied with the advantage of obtaining steam containing a greater store of energy.

With regard to the actual setting of the boiler, economiser, and fan, it is important to keep the passages short and direct, avoiding all quick bends, also to do everything possible to prevent air leakage. There must also be provided plenty of explosion doors, which must be air-tight when closed. So important is the prevention of air leakage, that the author is of opinion that where waste-heat boilers are to be used the air valves of the furnace should be water-sealed, as the butterfly valves usually used for air are far from being tight.

A good lay-out of the plant is shown in fig. 1, from which it will be seen that a three-way water-sealed valve of the drum type is arranged to send the products either to the boiler or direct to the chimney, and that the fan discharges back into the chimney, as even at their low temperature, after passing over boiler and economiser, some pull could be got from the chimney to help the fan.

Collecting the more important results of the tests, the following table is obtained :—

Item.	Exp.	I.	II.	III.	IV.
Heat usefully employed in boiler, lb.-cal.	1,555,000	2,540,000	2,360,000	2,934,000	3,031,000
Weight of steam of dryness factor 0·95 generated per hour, lb.	2,440	3,792	3,723	4,616	4,786
Weight of steam per ton of ingots, lb.	1,084	949·3	855·3	1,232	766·9

The average of the above weights of steam per ton of ingots is 987·5 lb. As only one of the boilers in the above test was receiving all the waste products of combustion, and it was too small to real properly with the amount, and the others were only using about two-thirds of the products from their respective furnaces, there seems reason to believe that at least 1,200 lb. of steam per ton of ingots would have been obtained under more favourable conditions.

Experience has shown that in a steelworks making plates and bars, and in which the power plant is not particularly up to date, most of the mill engines being of the simple high-pressure type, the shears being similarly driven, and even some of the live roller racks being driven by small and wasteful engines, while the pipe ranges are of considerable length, the steam consumption works out at 3,200 lb. per ton of ingots. Even in such a case, therefore, the saving in boiler fuel which could be effected by the use of waste-heat boilers on the smelting furnaces would be 43·75 per cent. Another source of steam, not dealt with in the paper, is the waste heat from the re-heating furnaces. A very conservative estimate makes the saving, under the conditions named above, 50 per cent. in boiler fuel by using heat at present wasted.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

14,619. "Automatic switches, circuit systems, and operating methods." W. CROSS (HULFISH) & D. S. HULFISH. September 9th.

14,646. "Ignition mechanism." SPLITDORF ELECTRICAL CO. September 9th. (U.S.A., January 2nd.)

14,680. "Dynamo-electric machinery." E. GREENHALGH, LO-THERMO PATENTS, LTD., & B. LONGBOTTOM. September 10th.

14,703. "Signalling systems." T. W. CASE. September 10th.

14,704. "Variable resistances." T. W. CASE. September 10th.

14,705. "Light reactive resistance elements." T. W. CASE. September 10th.

14,715. "Electrical system for generating intermittent high-tension current impulses for ignition purposes." C. H. TOWER. September 10th.

14,731. "Electric arc-striking devices." H. B. RAWLINGS. September 10th.

14,738. "Terminal fittings of incandescent electric lampholders." G. F. COLSON. September 11th.

14,751. "Amplifying devices." E. S. HEURTLEY. September 11th.

14,767. "Means for securing shades to holders of electric lamps." H. F. WHEELER. September 11th.

14,778. "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) September 11th.

14,795. "Electric transmission of voices and music." M. TOCCHIO. September 11th.

14,806. "Electrical switches." C. H. LANDER. September 11th.

14,807. "Electrical generating machines." C. H. LANDER. September 11th.

14,815. "Electrically-operated pulley blocks, hoists, &c." H. MORRIS, LTD., G. A. ROBERTSON & N. W. WESTON. September 12th.

14,581. "Instruments for testing batteries, accumulators, motor dynamos, &c." A. A. PRICE. September 12th.

14,856. "Wattmeters." E. BJERKNES. September 12th.

14,857. "Electrodes for electric-arc welding." W. H. BOORNE. September 12th.

14,859. "Electrodes for primary and secondary batteries." FULLER ACCUMULATOR CO. & T. JONES. September 12th.

14,861. "Electric motor-control systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) September 12th.

14,932. "Electrical current-regulating apparatus." C. B. WATERS. September 13th. (U.S.A., July 2nd.)

14,943. "Method of electrical treatment of gases." L. BRADLEY. September 13th. (U.S.A., June 21st, 1916.)

14,944. "Apparatus for electrical treatment of gases." L. BRADLEY. September 13th. (U.S.A., June 21st, 1916.)

14,947. "Electrical treatment of gases." L. BRADLEY. September 13th. (U.S.A., June 21st, 1916.)

14,965. "Electromagnetic control of electric arcs." A. E. ANGOLD, A. H. RAILING & M. SOLOMON. September 14th.

14,983. "Wheels for cam shafts and magnetos on internal-combustion engines, &c." G. DURRANT. September 14th.

14,984. "Direct conversion of basic or heat energy in energy-carrying fluids into electrical energy." F. HAMER. September 14th.

14,987. "Power modulators for radio transmission." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) September 14th.

15,002. "Sparking plug for internal-combustion engines." C. BLANDIN. September 14th. (France, September 29th, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

7,118. SPARKING PLUGS. J. A. Turner & A. Harms. May 17th, 1917. (118,292.)

7,329. ELECTRODES FOR ARC SOLDERING. A. B. Pescatore. May 21st, 1917. (118,296.)

10,365. ELECTRICAL HEATING ELEMENTS SUITABLE FOR COOKING AND SIMILAR HEATING APPARATUS. A. F. Berry. July 18th, 1917. (118,300.)

11,936. APPARATUS RESPONSIVE TO SUNLIGHT FOR COMPLETING AN ELECTRIC CIRCUIT FOR GIVING A SIGNAL OR FOR OTHER PURPOSES. O. Evensen & E. Johannessen. August 25th, 1916. (109,053.)

11,993. IGNITION DYNAMOS. E. C. R. Marks (Splitdorf Electrical Co., U.S.A.). August 21st, 1917. (118,318.)

11,996. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. F. Hird & H. W. F. Ireland. August 21st, 1917. (118,319.)

12,016. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.A.) August 21st, 1917. (118,320.)

12,035. SWITCHGEAR FOR STARTING AND CONTROLLING ELECTRIC MOTORS. J. A. Hirst & P. S. Brook. August 22nd, 1917. (118,324.)

12,123. PRODUCTION OF COLOUR MUSIC AND APPARATUS THEREFOR. A. B. Hector. August 31st, 1916. (109,263.)

12,165. ELECTRICALLY-OPERATED MECHANISM SUITABLE FOR DRIVING CLOCKWORK TRAINS OR THE LIKE. F. Holden. August 24th, 1917. (118,329.)

12,199. ELECTRIC SIGNALLING SYSTEMS, MORE PARTICULARLY FOR USE IN MINES. Automatic Telephone Manufacturing Co. & C. Remington. August 25th, 1917. (118,330.)

13,822. MINE SIGNALLING APPARATUS. Clay Cross Co. & J. W. Strong. September 26th, 1917. (118,354.)

13,884. ELECTROLYTIC CELLS, ADAPTED FOR THE MANUFACTURE OF CAUSTIC ALKALI FROM SODIUM CHLORIDE. N. Statham. September 26th, 1917. (118,355.)

13,956. ELECTRIC FURNACES. H. Wade (Booth-Hall Co., U.S.A.). September 27th, 1917. (118,357.)

16,722. MAGNETIC LOCKS OR FASTENINGS FOR USE ON ELECTRIC LAMPS OR OTHER APPARATUS. Fuller Accumulator Co. & A. P. Welch. November 14th, 1917. (118,370.)

16,915. METHOD OF ASSEMBLING UPON A BEDPLATE THE FIXED LAMINATED POLE PIECES IN MAGNETOS HAVING A STATIONARY ARMATURE. E. C. R. Marks (Soc. Anon. des Etablissements L. Bleriot). December 18th, 1916. (Divided application on 18,144/16.) (118,372.)

18,567. ELECTRIC SWITCH PLUGS. R. Crust. December 14th, 1917. (118,378.)

18,861. ROTARY FIELD MAGNETS. Aktiebolaget Ljungstroms Angturbin. December 19th, 1916. (112,442.)

1918.

201. FREE-RELEASE ELECTRIC CIRCUIT BREAKERS. G. Seligman & Allmanna Svenska Elektriska Aktiebolaget. January 4th, 1918. (118,380.)

616. ELECTRIC STARTING APPARATUS FOR MOTOR-VEHICLE ENGINES. H. Lucas and C. L. Breeden. January 10th, 1918. (118,220.)

1,075. VOLTAGE REGULATING DEVICES. J. Bethenod. April 24th, 1917. (115,226.)

1,277. ELECTRICAL STARTING AND LIGHTING SYSTEMS FOR AUTOMOBILE VEHICLES. J. Bethenod. August 11th, 1917. (118,231.)

1,328. RAILWAY SIGNALLING. McKenzie, Holland & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) January 23rd, 1918. (118,382.)

1,531. TELEPHONE DIAPHRAGMS. F. L. Hoyt. January 26th, 1918. (118,224.)

1,804. CONNECTIONS OR CONNECTORS FOR ELECTRIC CONDUCTORS. K-W Ignition Co. July 12th, 1917. (118,083.)

1,895. CIRCUIT-BREAKERS FOR IGNITION SYSTEMS. K-W Ignition Co. July 23rd, 1917. (118,084.)

1,907. SECONDARY OR STORAGE CELLS OR BATTERIES. J. Y. Johnson (Commercial Truck Co., U.S.A.). February 1st, 1918. (118,227.)

3,090. DYNAMO-ELECTRIC MACHINERY. J. W. Burleigh. March 2nd, 1918. (118,392.)

3,460. SUPPLY OF ELECTRICAL ENERGY TO FURNACES OR OTHER APPLIANCES. W. Travis & T. H. Watson & Co. February 27th, 1918. (118,233.)

4,017. MECHANISM FOR VARYING THE POINT OF IGNITION IN MAGNETO-ELECTRIC IGNITION APPARATUS. Brown, Boveri et Cie Akt. Ges. March 2nd, 1918. (114,829.)

4,039. ARMATURES FOR MAGNETO OR DYNAMO-ELECTRIC MACHINES. Compagnie Generale de Magnetos. May 11th, 1917. (116,895.)